Engine/Emissions-Diagnosis

1987 Shop Manual

Volume H Car/Truck

Ford

ATTENTION!

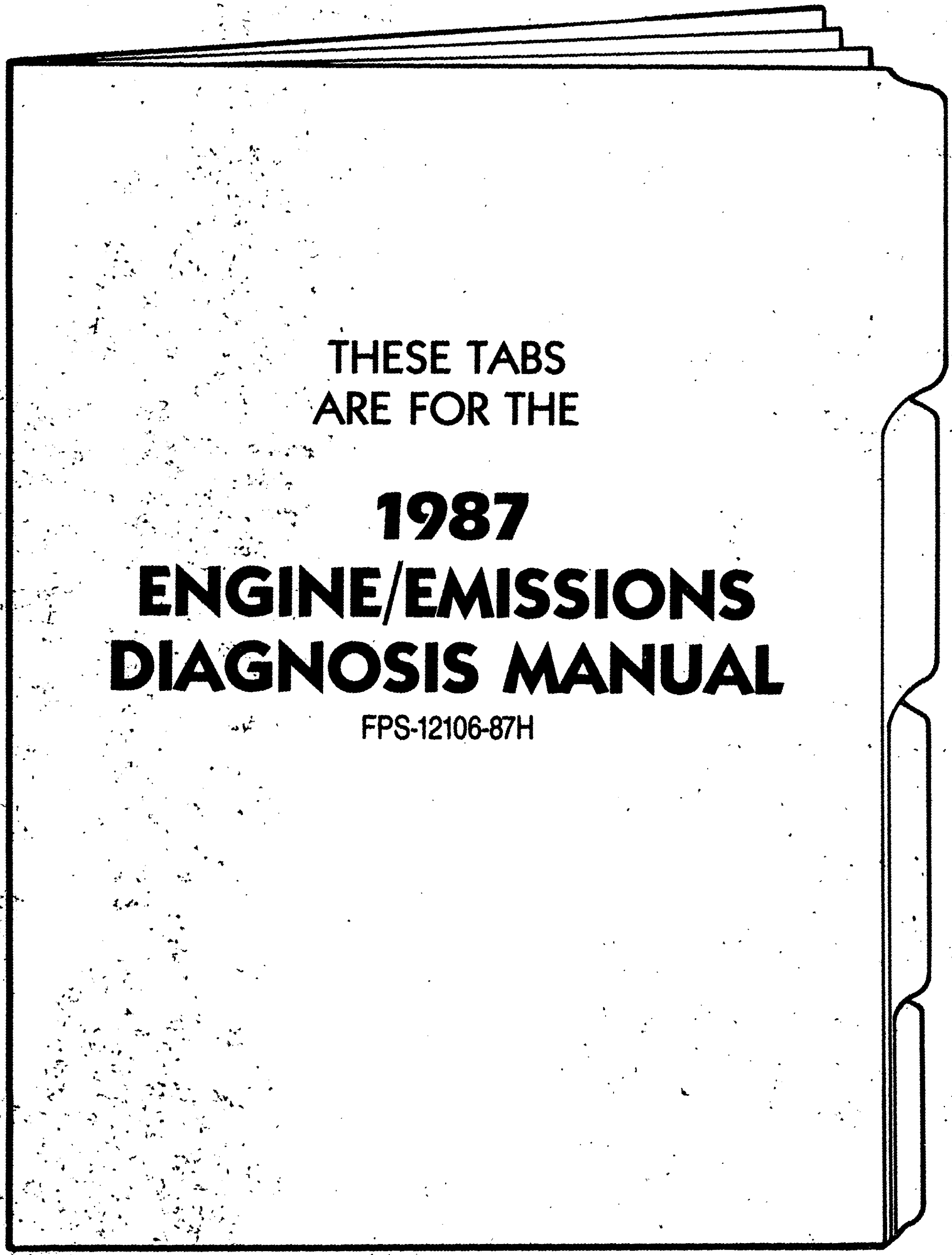
SERVICE MANAGERS AND SERVICE TECHNICIANS

This is your master Engine/Emissions Diagnosis Manual for the 1987 model year. This looseleaf binder will be updated with supplements to cover any new componentry as well as any changes or modifications to existing systems and components.

The first tab in the binder is for special Specifications Bulletins; periodic issues of TSB'S which provide performance specifications (approximately three mailings per year).

In order to properly diagnose and service engine/emissions components, it is imperative that this manual be kept up-to-date with change packages and the special TBS's and, that the manual is available to service technicians who perform this type of diagnosis and service.

Ford Parts and Service Division



THESE TABS
ARE FOR THE

1987
ENGINE/EMISSIONS DIAGNOSIS MANUAL

FPS-12106-87H

Important Safety Notice

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual doing the work. This Shop Manual provides general directions for accomplishing service and repair work with tested, effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work. This Manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this Manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

Notes, Cautions, and Warnings

As you read through the procedures, you will come across NOTES, CAUTIONS, and WARNINGS. Each one is there for a specific purpose. NOTES give you added information that will help you to complete a particular procedure. CAUTIONS are given to prevent you from making an error that could damage the vehicle. WARNINGS remind you to be especially careful in those areas where carelessness can cause personal injury. The following list contains some general WARNINGS that you should follow when you work on a vehicle.

- Always wear safety glasses for eye protection.
- Use safety stands whenever a procedure requires you to be under the vehicle.
- Be sure that the ignition switch is always in the OFF position, unless otherwise required by the procedure.
- Set the parking brake when working on the vehicle. If you have an automatic transmission, set it in PARK unless instructed otherwise for a specific operation. If you have a manual transmission, it should be in REVERSE (engine OFF) or NEUTRAL (engine ON) unless instructed otherwise for a specific operation. Place wood blocks (4″ x 4″ or larger) to the front and rear surfaces of the tires to provide further restraint from inadvertent vehicle movement.
- Operate the engine only in a well-ventilated area to avoid the danger of carbon monoxide.
- Keep yourself and your clothing away from moving parts, when the engine is running, especially the fan and belts.
- To prevent serious burns, avoid contact with hot metal parts such as the radiator, exhaust manifold, tail pipe, catalytic converter and muffler.
- Do not smoke while working on a vehicle.
- To avoid injury, always remove rings, watches, loose hanging jewelry, and loose clothing before beginning to work on a vehicle.
- Keep hands and other objects clear of the radiator fan blades. The electric cooling fan on the 2.3L turbocharged engine can start to operate at any time by an increase in underhood temperature, even though the ignition is in the OFF position. The Tempo/Topaz and Escort/Lynx electric cooling fan can start at any time for the same reason, but only when the ignition switch is in the ON position. Therefore, care should be taken to ensure that the electric cooling fan motor is completely disconnected when working under the hood.

Foreword

This 1987 Car Shop Manual provides information covering Emissions for all 1987 Ford Motor Company Passenger Cars and Trucks manufactured in the United States and Canada. Complete emissions related diagnostic procedures for all affected systems or components are covered in this manual.

The descriptions and specifications contained in this manual were in effect at the time this manual was approved for printing. Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design without notice and without incurring obligation.

For service information on specific vehicle lines for Body, Chassis and Electrical; Powertrains; and/or Pre-Delivery, Maintenance and Lubrication, refer to the Passenger Car and Truck Cross Index pages in the front of this manual.

Ford Parts and Service Division
Training and Publications Department

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Cross Index

Manual	Content	Vehicle Lines
A	Body, Chassis, Electrical	Lincoln Town Car, Ford Crown Victoria/ Mercury Grand Marquis
B	Body, Chassis, Electrical	Mark VII/Continental Thunderbird/Cougar Mustang
C	Body, Chassis, Electrical	Tempo/Topaz Escort/Lynx
D	Powertrain, Lubrication, Maintenance	Lincoln Town Car, Ford Crown Victoria Mercury Grand Marquis Mark VII/Continental, Thunderbird/Cougar Mustang
E	Powertrain, Lubrication, Maintenance	Tempo/Topaz Escort/Lynx, EXP
F	Pre-Delivery	All Models
G	Body, Chassis, Electrical, Powertrain, Maintenance, Lubrication	Taurus/Sable
H	Engine/Emissions Diagnosis	All Car & Truck Models

Cross Index

Manual	Content	Vehicle Lines
A	Body, Chassis, Electrical	Bronco, Econoline (E-150 through E-350) (F-150 through F-350)
B	Engine	Bronco, Econoline (E-150 through E-350) (F-150 through F-350)
C	Pre-Delivery, Hoisting and Jacking	All Truck Series
D	Body, Chassis, Electrical	F-, FT, B-, C-600 through 8000 Series
E	Engine	F-, FT, B-, C-600 through 8000 Series
H	Engine/Emissions Diagnosis	All Car & Truck Models

OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS

ORDERING INFORMATION
A special order form is included in the back of this manual for your convenience if you desire to order.

ENGINE EMISSIONS FACTS BOOK

- The manual contains complete specifications for each calibration number.
- Published at the conclusion of the model year.

ELECTRICAL & VACUUM TROUBLESHOOTING MANUAL (EVTM)

- Available for all passenger car and light truck vehicles, this publication provides schematics of all electrical and vacuum circuits. Wiring diagrams show how the circuit is powered. Troubleshooting hints are provided to point the technician in a general direction but are not step by step procedures.
- Available in the first quarter of the model year. (One manual for each passenger car and light truck family.)

WIRING & VACUUM DIAGRAMS

- This publication contains wiring diagrams for all Ford and Lincoln/Mercury passenger car and light truck vehicles. A Power Distribution system illustrates the power distribution throughout each vehicle. In addition, all individual electrical circuits are shown for each vehicle line.
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ENGINE/EMISSIONS
DIAGNOSIS

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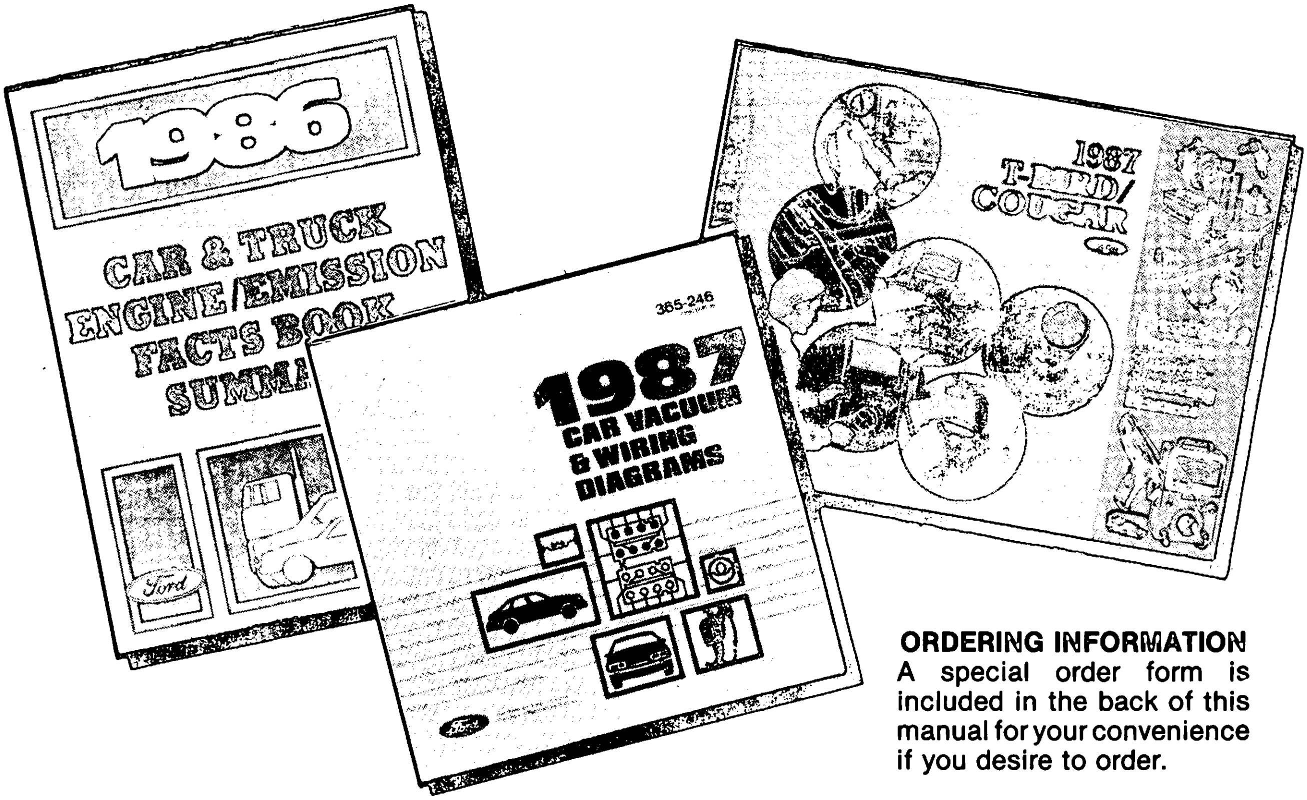

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SECTION 1

Emission Control Identification/Application

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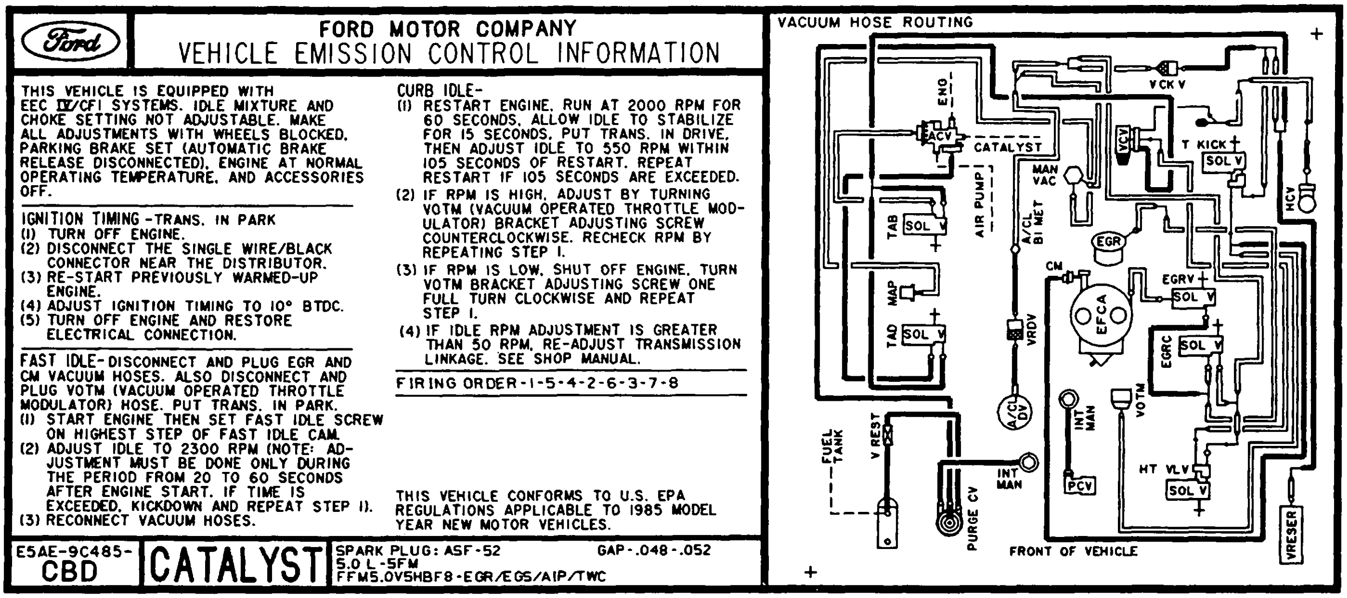
Emissions Control Identification / Application

VEHICLE EMISSION CONTROL INFORMATION

Each vehicle is equipped with a decal (Fig. 1) containing emission control data that applies specifically to that vehicle and engine. The specifications provided on the decal are critical to servicing emissions systems.


VACUUM HOSE ROUTING
ENG
ACV
CATALYST
AIR PUMP
VCK V
VCV
T KICK
SOL V
MAN VAC
A/CL BI MET
HCV
TAB
SOL V
EGR
CM
EGRV
SOL V
MAP
TAD
SOL V
VRDV
EFCA
EGRC
SOL V
A/CL DV
INT MAN
VOTM
FUEL TANK
V REST
INT MAN
PURGE CV
PCV
HT VLV
SOL V
VRESER
FRONT OF VEHICLE

FORD MOTOR COMPANY
VEHICLE EMISSION CONTROL INFORMATION

THIS VEHICLE IS EQUIPPED WITH EEC IV/CFI SYSTEMS. IDLE MIXTURE AND CHOKE SETTING NOT ADJUSTABLE. MAKE ALL ADJUSTMENTS WITH WHEELS BLOCKED, PARKING BRAKE SET (AUTOMATIC BRAKE RELEASE DISCONNECTED), ENGINE AT NORMAL OPERATING TEMPERATURE, AND ACCESSORIES OFF.

IGNITION TIMING -TRANS. IN PARK
(1) TURN OFF ENGINE.
(2) DISCONNECT THE SINGLE WIRE/BLACK CONNECTOR NEAR THE DISTRIBUTOR.
(3) RE-START PREVIOUSLY WARMED-UP ENGINE.
(4) ADJUST IGNITION TIMING TO 10° BTDC.
(5) TURN OFF ENGINE AND RESTORE ELECTRICAL CONNECTION.

FAST IDLE-DISCONNECT AND PLUG EGR AND CM VACUUM HOSES. ALSO DISCONNECT AND PLUG VOTM (VACUUM OPERATED THROTTLE MODULATOR) HOSE. PUT TRANS. IN PARK.
(1) START ENGINE THEN SET FAST IDLE SCREW ON HIGHEST STEP OF FAST IDLE CAM.
(2) ADJUST IDLE TO 2300 RPM (NOTE: ADJUSTMENT MUST BE DONE ONLY DURING THE PERIOD FROM 20 TO 60 SECONDS AFTER ENGINE START. IF TIME IS EXCEEDED, KICKDOWN AND REPEAT STEP 1).
(3) RECONNECT VACUUM HOSES.

CURB IDLE-
(1) RESTART ENGINE. RUN AT 2000 RPM FOR 60 SECONDS. ALLOW IDLE TO STABILIZE FOR 15 SECONDS. PUT TRANS. IN DRIVE. THEN ADJUST IDLE TO 550 RPM WITHIN 105 SECONDS OF RESTART. REPEAT RESTART IF 105 SECONDS ARE EXCEEDED.
(2) IF RPM IS HIGH, ADJUST BY TURNING VOTM (VACUUM OPERATED THROTTLE MODULATOR) BRACKET ADJUSTING SCREW COUNTERCLOCKWISE. RECHECK RPM BY REPEATING STEP 1.
(3) IF RPM IS LOW, SHUT OFF ENGINE. TURN VOTM BRACKET ADJUSTING SCREW ONE FULL TURN CLOCKWISE AND REPEAT STEP 1.
(4) IF IDLE RPM ADJUSTMENT IS GREATER THAN 50 RPM, RE-ADJUST TRANSMISSION LINKAGE. SEE SHOP MANUAL.

FIRING ORDER-1-5-4-2-6-3-7-8

THIS VEHICLE CONFORMS TO U.S. EPA REGULATIONS APPLICABLE TO 1985 MODEL YEAR NEW MOTOR VEHICLES.

E5AE-9C485-
CBD

CATALYST

SPARK PLUG: ASF-52 GAP-.048-.052
5.0 L-5FM
FFM5.0V5HBF8-EGR/EGS/AIP/TWC

Figure 1 Typical Vehicle Emission Control Information Decal

In addition to the tune-up specifications and procedures, the emission decal shows a color coded schematic of the engine vacuum system. The color coding on the schematic represents the actual color coding on the vacuum hoses. However, there will be instances where an individual hose color will not agree.

VEHICLE EMISSION CONTROL INFORMATION DECAL LOCATION

VEHICLE	LOCATION
Escort/Lynx, EXP 1.9L	Radiator Sight Shield
Tempo/Topaz 2.3L	Radiator Sight Shield
Mustang 2.3L, 5.0L	Coil Appearance Cover
Merkur 2.3L Turbo	Radiator Sight Shield
Thunderbird/Cougar 2.3 Turbo	Sight Shield on Fan Assembly
3.8L	Fan Shroud
5.0L	Coil Appearance Cover
Taurus/Sable 2.5L, 3.0L	Radiator Sight Shield
Ford/Mercury	Fan Shroud
Mark VII/Continental, Town Car 5.0L	Fan Shroud
Ranger, F-Series, Bronco/Bronco II, Aerostar 2.0L, 2.3L, 2.8L, 2.9L, 3.0L, 4.9L, 5.0L, 5.8L, 6.1L, 7.0L, 7.5L	Radiator Support
Econoline All Engines	Under Hood

CA9834-A

Emissions Control Identification / Application

Engine Calibration Identification

Located on the front of the engine, there is an Engine Code Information Label containing—among other pertinent data—an engine calibration number. Although there are several label styles, the engine calibration number is shown on each (Figure 2).

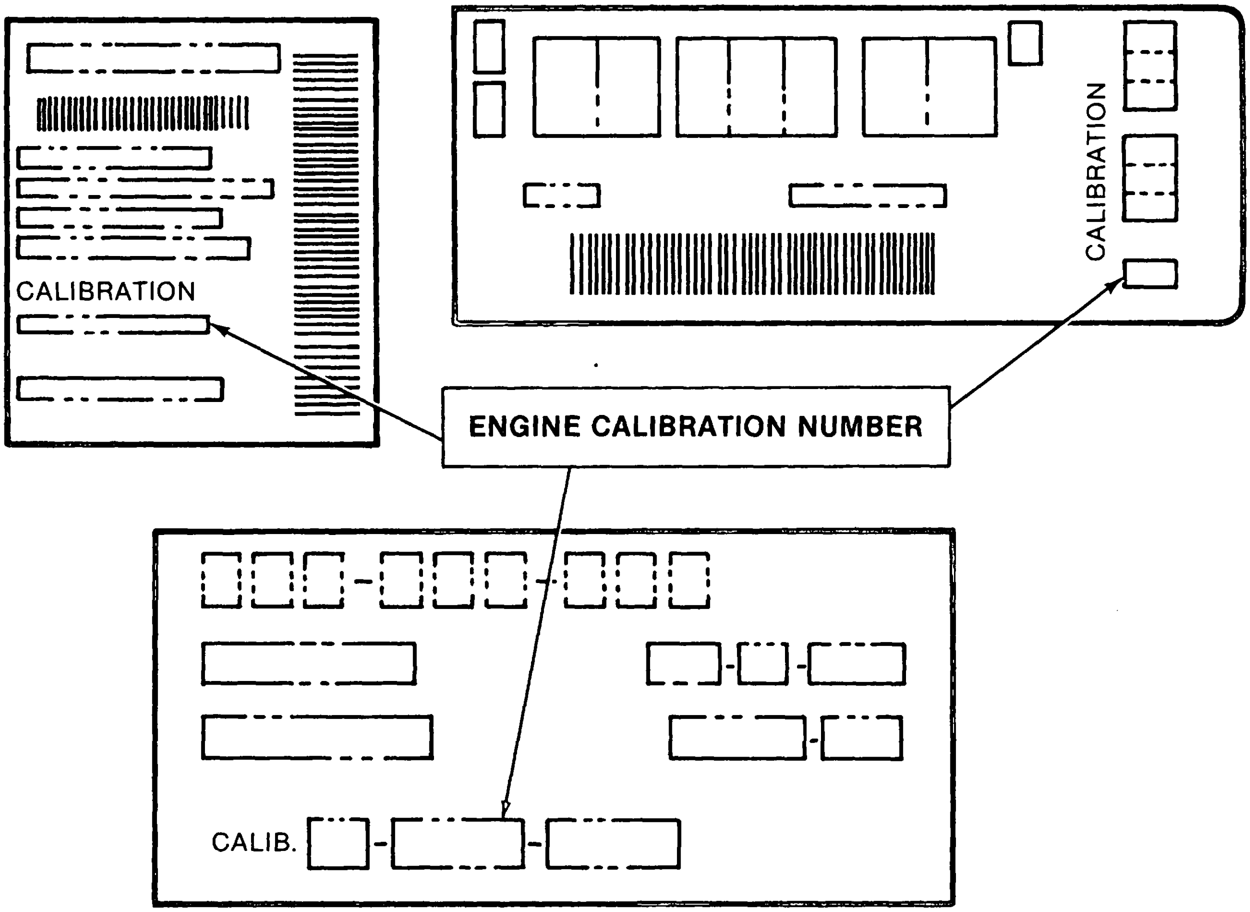


Figure 2 Engine Code Information Label With Engine Calibration Number

Emissions Control Identification/Application

EMISSION CONTROLS APPLICATION

PASSENGER CAR — 50 STATES/CANADA

Engine	Vehicle Application	Catalyst(s)		Fuel System Type, Mfg	Electronic Eng Ctrl	EGR System	Secondary Air System	Ignition System	Idle Speed Control
		Type	Location						
1.9L	Escort/Lynx, EXP	TWC	CCC	CFI	EEC-IV	PFE	None	TFI-IV	DCM
1.9L	Escort/Lynx, EXP	TWC COC	DBUB	EFI	EEC-IV	BVT	Dual PA	TFI-IV	BPA
2.3L OHC	Mustang	TWC TWC	TB UB	EFI	EEC-IV	EEGR	None	TFI-IV	BPA
2.3L OHC Turbo	Thunderbird Merkur	TWC TWC	DBUB	EFI	EEC-IV	Ported	None	TFI-IV	BPA
2.3L HSC 50 States	Tempo/Topaz	TWC COC	DBUB	CFI	EEC-IV	EEGR	PA	TFI-IV	DCM
2.3L HSC Canada	Tempo/Topaz	TWC	SBUB	1949-1V Holley	None	Ported	MTA	DS-II	TSP
2.3L HSC Plus	Tempo/Topaz	TWC COC	DBUB	CFI	EEC-IV	EEGR	PA	TFI-IV	DCM
2.5L HSC	Taurus/Sable (Man)	TWC COC	DBUB	CFI	EEC-IV	EEGR	None	TFI-IV	DCM
2.5L HSC	Taurus/Sable 1987-1/2 (Auto)	TWC TWC	DBUB	CFI	EEC-IV	EEGR	None	TFI-IV	DCM
3.0L	Taurus/Sable	TWC	UE	EFI	EEC-IV	None Canada-PFE	None	TFI-IV	BPA
3.8L	Thunderbird/Cougar	(2) TWC COC	TB UB	CFI	EEC-IV	EEGR	MTA	TFI-IV	DCM
	Thunderbird/Cougar 1987-1/2	(2) TWC TWC	TB UB	EFI	EEC-IV	PFE	None	TFI-IV	BPA
	Taurus Police Only 1987-1/2	(2) TWC TWC	CCC UB	EFI	EEC-IV	PFE	None	TFI-IV	BPA
5.0L	Thunderbird/Cougar Cont/Mark VII	(2) TWC COC	TB UB	SEFI	EEC-IV	EEGR	MTA	TFI-IV	BPA
	Ford/Mercury Ford Police Town Car	(2) TWC (2) COC	TB UB	SEFI	EEC-IV	EEGR	MTA	TFI-IV	BPA
5.0L HO	Mustang Mark VII	(2) TWC (2) COC	TB UB	SEFI	EEC-IV	EEGR	MTA	TFI-IV	BPA
5.8L	Ford/Mercury (Canada) Ford Police	(2) TWC COC	DBUB	7200-VV FBC, Ford	MCU	IBP	MTA	UIC	TSP

ABBREVIATIONS:

BPA = Bypass Air
CCC = Close Coupled Configuration
CFI = Central Fuel Injection
COC = Conventional Oxidation Catalyst
DBUB = Dual Brick Underbody
DCM = D.C. Motor
DS-II = Duraspark II
EEC-IV = Electronic Engine Control (System-IV)
EEGR = Electronic EGR Valve (Sonic)
EFI = Electronic Fuel Injection
EGR = Exhaust Gas Recirculation
HO = High Output
HSC = High Swirl Combustion
IBP = Integral Backpressure
MCU = Microprocessor Control Unit
Mfg = Manufacturer
MTA = Managed Thermactor Air
OHC = Overhead Cam
PA = Pulse Air
PFE = Pressure Feedback Electronic EGR
SEFI = Sequential EFI
TB = Toe Board
TFI = Thick Film Ignition
TSP = Throttle Solenoid Positioner
TWC = Three-Way Catalyst
UB = Underbody
UE = Under Engine
UIC = Universal Ignition Control
V = Venturi
VV = Variable Venturi

CA9134-B

Emissions Control Identification/Application

EMISSION CONTROLS APPLICATION

LIGHT TRUCK — 50 STATES/CANADA

Engine	Vehicle Application	Catalyst(s)		Fuel System Type, Mfg	Electronic Eng Ctrl	EGR System	Secondary Air System	Ignition System	Idle Speed Control
		Type	Location						
2.0L OHC	Ranger (49 States)	TWC COC	DBUB	Aisan Y NFB	None	Ported	CT	DS-II	DCM
2.3L OHC	Ranger Aerostar (49 States)	TWC	UB	EFI	EEC-IV	EEGR	None	TFI-IV	BPA
	Ranger (Calif)	TWC TWC	DBUB	EFI	EEC-IV	EEGR	None	TFI-IV	BPA
	Aerostar (Calif.)	TWC TWC	(2) SBUB	EFI	EEC-IV	EEGR	None	TFI-IV	BPA
2.9L	Ranger/Bronco II	TWC TWC	(2) SBUB	EFI	EEC-IV	PFE	None	TFI-IV	BPA
3.0L	Aerostar	TWC TWC	(2) SBUB	EFI	EEC-IV	None	None	TFI-IV	BPA
4.9L	E-Series/F-Series Bronco	TWC (2) COC	UB #1 UB #2	EFI	EEC-IV	EEGR	MTA/ AM1, AM2	TFI-IV	BPA
5.0L	E-Series/F-Series Bronco	TWC (2) COC	UB #1 UB #2	EFI	EEC-IV	EEGR	MTA/ AM1, AM2	TFI-IV	BPA
5.8L	E-Series/F-Series Bronco	TWC (2) COC	UB #1 UB #2	4180-C-4V NFB, Holley	None	IBP	MTA	DS-II	None
7.5L	E-Series/F-Series	None	NA	4180C-4V Holley	None	Ported	MTA	DS-II	None
7.5L	E-Series/F-Series 1987-1/2	(4) REDOX	UB	EFI	EEC-IV	EEGR	MTA	TFI-IV	BPA

ABBREVIATIONS:

AM (1), AM(2) = Air Management (1), (2)
BPA = Bypass Air
COC = Conventional Oxidation Catalyst
CT = Conventional Thermactor
DBUB = Dual Brick Underbody
DCM = D.C. Motor
DS-II = Duraspark II
EEC-IV = Electronic Engine Control (System-IV)
EEGR = Electronic EGR Valve (Sonic)
EFI = Electronic Fuel Injection
EGR = Exhaust Gas Recirculation
IBP = Integral Backpressure
Mfg = Manufacturer
MTA = Managed Thermactor Air
NA = Not Applicable
NFB = Non-Feedback Carburetor
PFE = Pressure Feedback Electronic
REDOX = Reduction-Oxidation
SBUB = Single Brick Underbody
TFI = Thick Film Ignition
TWC = Three-Way Catalyst
UB = Underbody

CA9135-B

Emissions Control Identification / Application

EMISSION CONTROLS APPLICATION

MEDIUM/HEAVY TRUCK — 50 STATES/CANADA

Engine	Vehicle Application	Catalyst(s)		Fuel System Carb, Mfg	Electronic Eng Ctrl	EGR System	Thermactor System	Ignition System	Idle Speed Control
		Type	Location						
4.9L	E-Series/F-Series	TWC COC	UB #1 UB #2	EFI	EEC-IV	EEGR	MTA/ AM1, AM2	TFI-IV	BPA
5.8L	E-Series/F-Series	None	NA	4180C-4V NFB, Holley	None	IBP	MTA	DS-II	None
5.8L	E-Series/F-Series 1987-1/2	TWC COC	UB # 1 UB # 2	4180C-4V NFB; Holley	None	IBP	MTA	DS-II	None
6.1L	B-Series F-Series	None	NA	4190EG-4V Holley	None	Ported	CT	DS-II	None
7.0L	B-Series F-Series	None	NA	4190EG-4V Holley	None	Ported	CT	DS-II	None

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AM (1), AM(2) = Air Management (1), (2)
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EEGR = Electronic EGR Valve (Sonic)
EFI = Electronic Fuel Injection
EGR = Exhaust Gas Recirculation
IBP = Integral Backpressure
Mfg = Manufacturer
MTA = Managed Thermactor Air
NA = Not Applicable
NFB = Non-Feedback Carburetor
TFI = Thick Film Ignition
TWC = Three-Way Catalyst
UB = Underbody
V = Venturi

CA9136-B

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SECTION 2

Diagnostic Routines

Contents

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Diagnostic Routines 2-3

Diagnostic Routines

PREFACE

The Diagnostic Routines lists the components and systems that can contribute to a particular condition in the order of probability, ease of accomplishment, and accessibility. These Routines can be used as check lists for reference in the event of unusual or infrequent causes of malfunction.

It is not necessary that any given order be followed, but it makes good sense for the technician to visually inspect everything that his experience tells him could be the source of the condition before beginning a more involved diagnosis. The effectiveness of every service must be validated.

All references, under the REFERENCE column in each Diagnostic Routine chart, are as follows:

- Group numbers reference a group number shown in the Powertrain, or Body, Chassis and Electrical Shop Manuals.
- Section numbers reference a section in the Engine/Emissions Diagnosis manual.
- Special manual publications are referenced in some cases.

Diagnostic Routines

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CA5628-C

Diagnostic Routines

201	CRANKS NORMALLY BUT WON'T START	
System	**Component**	**Reference**
Ignition	Electrical Connections Secondary Ignition Wires Ignition Coil Ignition Module Rotor Alignment Distributor Cap, Adapter, Rotor & Stator Spark Plugs Fouled Ignition Switch	Section 15 and Group 23
External Carburetor/Fuel Charging Assy./Throttle Body	Electrical and Vacuum Connections Choke Plate and Linkage Cold Enrichment Rod and Linkage (7200) Venturi Valve (7200) Throttle Linkages	Visual, Section 4, and Group 24
EGR	Valve	Section 6
Internal Carburetor	Float/Inlet Needle and Seat Idle Air Bleeds and Fuel Passages	Section 4 and Group 24
Fuel Delivery	Filter Pump Water/Dirt/Rust Contamination in Fuel Lines Tank (Fuel Supply) Dual Tanks (Selector Switch) Sender Filter Inertia Switch	Visual, Section 11 (for mechanical pumps), Section 16 (for electric pumps), and Group 24
EEC	Quick Test	Section 16
MCU	Component Diagnostics	Special MCU Diagnosis Manual
Basic Engine	Camshaft Timing Compression	Group 21

NOTE: Extended cranking, because of a "No Start" condition, can load the exhaust system with raw fuel, which can ruin the catalytic converter after the engine starts. To prevent this, disconnect the thermactor air supply (and, if EFI/CFI, the injectors), and run engine until surplus fuel is used up before reconnecting.

CA5629-D

Diagnostic Routines

202	STARTS NORMALLY BUT WON'T RUN (STALLS)	
System	**Component**	**Reference**
External Carburetor/Fuel Charging Assy/Throttle Body	Electrical and Vacuum Connections Fast Idle Speed Choke Plate and Linkage Cold Enrichment Rod and Linkage (7200) Choke Pulldown Adjustment & Diaphragm Venturi Valve (7200) Choke Cap Indexing	Visual, Section 4, and Group 24
Ignition	Electrical Connections Secondary Ignition Wires Ignition Coil Ignition Module Rotor Alignment Distributor Cap, Adapter, Rotor & Stator Ignition Switch Ballast Resistor	Section 15 and Group 23
EGR	Valve	Section 6
Fuel Delivery	Filter Pump Water/Dirt/Rust Contamination in Fuel Lines Tank (Fuel Supply) Sender Filter Inertia Switch	Visual, Section 11 (for mechanical pumps), Section 16 (for electric pumps), and Group 24
EEC	Quick Test	Section 16
MCU	Component Diagnostics	Special MCU Diagnosis Manual
Internal Carburetor	Float/Inlet Needle and Seat Idle Air Bleeds and Fuel Passages	Group 24
Exhaust	Component (Restricted)	Section 5
Basic Engine	Camshaft and Valve Train	Group 21

CA7734-D

Diagnostic Routines

203	CRANKS NORMALLY BUT SLOW TO START	
System	**Component**	**Reference**
NOTE: It is a good practice to confirm that the correct starting procedure was being used by the customer before proceeding with diagnosis.		
External Carburetor/Fuel Charging Assy/Throttle Body	Electrical and Vacuum Connections Choke Plate and Linkage Cold Enrichment Rod and Linkage (7200) Choke Cap Indexing Accelerator Pump Venturi Valve (7200) Bowl Vents	Visual, Section 4, and Group 24
Fuel Delivery	Filter Pump Water/Dirt/Rust Contamination in Fuel Lines Sender Filter	Visual, Section 11 (for mechanical pumps), Section 16 (for electric pumps), and Group 24
Internal Carburetor/ Injectors	Hot Idle Compensator (may be external) Float/Inlet Needle and Seat Stepper Motor (7200) Cold Enrichment System (7200) Injectors	Visual, Section 3, Section 4, and Group 24
Ignition	Scope Engine for: Spark Plugs, Coil, Secondary Ignition Wires, Distributor Cap, Adapter & Rotor Spark Plugs Fouled	Visual, Section 15 and Group 23
Induction and Vacuum Distribution	Vacuum Leaks Air Cleaner Element Restricted	Visual, Audible, and Group 21
Cooling	Electric Fan (Hot Start Only)	Group 27
EGR	Valve	Section 6
PCV	Valve	Section 9
EVAP	Components	Section 7 and Group 24
EEC	Quick Test	Section 16
MCU	Component Diagnostics	Special MCU Diagnosis Manual

CA5631-E

Diagnostic Routines

204	**ROUGH IDLE**	
System	**Component**	**Reference**
Cooling	Fan or Electric Fan (Loose or Cracked)	Visual
Vacuum Distribution	Vacuum Leaks	Visual and Audible
External Carburetor/Fuel Charging Assy Throttle Body	Curb or Fast Idle Speeds Electrical and Vacuum Connections Choke Plate and Linkage Cold Enrichment Rod and Linkage (7200) Venturi Valve (7200) Choke Pulldown Bowl Vent	Visual, Section 4, and Group 24
Ignition	Scope Engine For: Spark Plug, Coil, Secondary Wires, Distributor Cap, Adapter and Rotor	Section 15 and Group 23
Carburetor	Idle Mixture	Section 4
EGR	Valve Vacuum Regulator	Section 6
PCV	Valve	Section 9
EVAP	Components	Section 7 and Group 24
Ignition Timing	Base plus Advance and Retard Functions	Section 15
Internal Carburetor/ Injectors	Idle, Air Bleeds or Fuel Passages Float/Inlet Needle and Seat Stepper Motor (7200) Hot Idle Compensator (may be external) Altitude Compensator Cold Enrichment System (7200) Injectors	Visual, Section 3, Section 4, and Group 24
EEC	Quick Test	Section 16
MCU	Component Diagnostics	Special MCU Diagnosis Manual
Turbocharger		Group 24
Exhaust	Pipes, Muffler, Catalyst Resonator, Heat Control Valve	Section 5
Basic Engine	Compression Valve Train Camshaft Intake Manifold Gaskets	Group 21

CA7735-D

Diagnostic Routines

205	MISSES UNDER LOAD	
System	**Component**	**Reference**
Ignition	Scope Engine For: Spark Plug, Coil, Secondary Wires, Distributor Cap, Adapter and Rotor	Section 15
EEC	Quick Test	Section 16
MCU	Component Diagnostics	Special MCU Diagnosis Manual
Fuel Delivery	Filter Pump Lines Sender Filter	Visual, Section 11 (for mechanical pumps), Section 16 (for electric pumps), and Group 24
External Carburetor/Fuel Charging Assy/Throttle Body	Electrical and Vacuum Connections Choke and Linkage Cold Enrichment Rod and Linkage (7200) Venturi Valves (7200)	Visual, Section 4, and Group 24
Internal Carburetor/ Injectors	Basic: Idle, Main, and Accelerator Pump Float/Inlet Needle and Seat Main Metering Fuel Enrichment Injectors	Visual, Section 3, Section 4, and Group 24
Ignition Timing	Base plus Advance and Retard Functions	Section 15

CA5633-E

206	STALLS ON DECEL OR QUICK STOP	
System	**Component**	**Reference**
External Carburetor/Fuel Charging Assy/Throttle Body	Curb or Fast Idle Speed Electrical and Vacuum Connections Throttle Devices Venturi Valve (7200)	Visual, Section 3, Section 4 and Group 24
EGR	Valve	Section 6
Internal Carburetor	Idle Airbleeds or Fuel Passages Stepper Motor (7200) Hot Idle Compensator (may be external) Float/Inlet Needle and Seat Cold Enrichment System (7200)	Visual, Section 3, Section 4, and Group 24
Turbocharger	Retard Switches	Group 24
EEC	Quick Test	Section 16
MCU	Component Diagnostics	Special MCU Diagnosis Manual

CA5634-E

Diagnostic Routines

207	HESITATES OR STALLS ON ACCELERATION	
System	**Component**	**Reference**
External Carburetor/Fuel Charging Assy/Throttle Body	Choke Plate and Linkage Electrical & Vacuum Connections Cold Enrichment Rod and Linkage (7200) Accelerator Pump Venturi Valve (7200)	Visual, Section 3, and Section 4
Induction and Vacuum Distribution	Vacuum Leaks	Visual and Audible
Induction	Air Cleaner Duct and Valve	Section 8
Ignition	Scope Engine For: Spark Plug, Coil, Secondary Wires, Distributor Cap, Adapter and Rotor	Section 15
External Carburetor/Fuel Charging Assy/Throttle Body	Curb or Fast Idle Speeds	Section 4 and Group 24
EGR	Valve	Section 6
Fuel Delivery	Filter Pump Water/Dirt/Rust Contamination in Fuel Lines Sender Filter	Visual, Section 11 (for mechanical pumps), Section 16 (for electric pumps), and Group 24
Internal Carburetor/ Injectors	VV Diaphragm (7200) Power Valve Stepper Motor (7200) Main System (Restriction) Injectors	Section 3, Section 4, and Group 24
EEC	Quick Test	Section 16
MCU	Component Diagnostics	Special MCU Diagnosis Manual
Turbocharger		Group 24
Ignition Timing	Base plus Advance and Retard Functions	Section 15
Exhaust (Restriction)	With Backpressure EGR System	Section 5

CA7736-D

208	BACKFIRE (INDUCTION OR EXHAUST)	
System	**Component**	**Reference**
Vacuum Distribution	Vacuum Leak(s)	Visual and Audible
Ignition	Scope Engine For: Spark Plug, Coil, Secondary Wires, Distributor Cap and Rotor, Crossed Wires	Section 15
External Carburetor	Choke Plate and Linkage	Visual and Section 4
Basic Engine	Intake Manifold Gaskets Compression Check Camshaft Valves	Group 21
Thermactor		Section 10
Pulse Air		Section 10
EEC	Quick Test	Section 16
MCU	Component Diagnostics	Special MCU Diagnosis Manual
Ignition Timing	Base plus Advance and Retard Functions	Section 15
Exhaust	Components (Restricted)	Section 5
Fuel Delivery	Filter Pump Water, Dirt, Rust, Contamination in Fuel Lines Sender Filter	Visual, Section 11 (for Mechanical Pumps), Section 16 (for Electric Pumps), and Group 24

CA7737-D

Diagnostic Routines

209	LACK OF POWER	
System	**Component**	**Reference**
External Carburetor/Fuel Charging Assy/Throttle Body	Electrical and Vacuum Connections Choke Plate and Linkage Accelerator Pump Venturi Valves (7200)	Visual, Section 4, and Group 24
Induction	Air Cleaner Duct and Valve and Element	Section 8
Fuel Delivery	Filter Pump Lines Sender Filter	Visual, Section 11 (for mechanical pumps), Section 16 (for electric pumps), and Group 24
EGR	Valve	Section 6
Internal Carburetor/ Injectors	Float/Inlet Needle and Seat Accelerator Pump Main Metering System Fuel Enrichment Altitude Compensator Stepper Motor (7200) Pullover Rod Sticking (1949) Injectors	Visual, Section 3, Section 4, and Group 24
Basic Engine	Compression Check Camshaft Valves	Group 21
Drive Train	Clutch, Automatic Transmission, Brakes	Groups 15, 16 and 17
EEC	Quick Test	Section 16
MCU	Component Diagnostics	Special MCU Diagnosis Manual
Turbocharger		Group 24
Exhaust	Components (Restricted)	Section 5
Ignition Timing	Base plus Advance Retard Functions	Section 15

CA5637-E

210	SURGE AT STEADY SPEED	
System	**Component**	**Reference**
External Carburetor/Fuel Charging Assy (Throttle Body)	Choke Plate and Linkage Electrical & Vacuum Connections Venturi Valves (7200)	Visual, Section 4, and Group 24
Vacuum Distribution	Vacuum Leaks	Visual, Audible
Fuel Delivery	Filter Pump Lines Sender Filter	Visual, Section 11 (for mechanical pumps), Section 16 (for electric pumps), and Group 24
Internal Carburetor/ Injectors	Idle, Main Systems Float/Inlet Needle and Seat Fuel Enrichment Systems Altitude Compensator Injectors	Visual, Section 3, Section 4, and Group 24
EGR	Valve	Section 6
EEC	Quick Test	Section 16
MCU	Component Diagnostics	Special MCU Diagnosis Manual
Turbocharger		Group 24
EVAP	Components	Section 7 and Group 24
Basic Engine	Valve Train and Camshaft Intake Manifold Gaskets	Group 21
Thermactor		Section 10
Ignition Timing	Base plus Advance and Retard Functions	Section 15

CA7738-D

Diagnostic Routines

211	**ENGINE DIESELS (OR IDLES TOO FAST)**	
System	**Component**	**Reference**
External Carburetor/Fuel Charging Assy/Throttle Body	Curb or Fast Idle Speeds Electrical and Vacuum Connections Throttle Positioner or Dashpot Throttle Plate and Linkage Choke Plate and Linkage Fast Idle Linkage Venturi Valves (7200) Speed Control Chain	Visual, Section 3, Section 4, and Group 24
Vacuum Distribution	Vacuum Leaks	Visual and Audible
Cooling	Overheating	Routine 218
Idle Speed Control	Components	Section 14 and Section 16
Induction	Vacuum Leaks	Group 21

If engine idles smoothly after being shut off, trouble is likely to be in the ignition switch, ignition harness, starter solenoid "IGN" tap, or EEC relay.

CA5639-E

212	**ENGINE NOISE**	
Symptom	**Component**	**Reference**
Squeal, Click, or Chirp	Oil Level (low) Valve Train Drive Belts (loose) Belt Driven Components EEC Solenoids	Visual, Audible, Section 3, Group 21, and Group 27
Rumble, Grind	Belt Driven Components	
Rattle	Component (loose)	
Hiss	Thermactor System (leak) Vacuum Distribution System (leak) Induction System (leak) Spark Plug (loose)	Visual, Audible, Section 10, and Group 21
	Cooling System (leak)	Visual and Audible
	EVAP System (leak)	Section 7
Snap	Secondary Ignition	Visual and Audible
Rap, Roar	Exhaust System (leak) Pulse Air System (air cleaner)	Visual, Audible, Section 5, and Section 10
Whine	Turbocharger (some whine is normal)	Audible
Knock	Connection Rod Bearing (worn) Main Bearing (worn) Piston Pin (loose) Piston to Bore Clearance (cold engine)	Group 21
	Fuel Pump	Group 24
	Detonation	Routine 215

CA7739-B

Diagnostic Routines

213	POOR FUEL ECONOMY	
System	**Component**	**Reference**
While fuel consumption is drastically increased for short-run operation, stop and go driving, trailer towing, extended winter warm-up periods, etc., as opposed to "trip" mileage, an attempt should be made to determine these factors when confronted with "poor mileage" conditions. However, since the operator is not always at fault, the following is appended:		
External Carburetor/Fuel Charging Assy/Throttle Body	Choke Plate and Linkage Cold Enrichment Rod and Linkage (7200) Electrical & Vacuum Connections	Visual and Section 4
Induction	Air Cleaner Duct and Valve Air Cleaner Element (Restricted)	Section 8
Ignition	Scope Engine For: Spark Plug, Coil, Secondary Wires, Distributor Cap, Adapter and Rotor	Section 15
Internal Carburetor	Idle, Main Systems Enrichment Systems Float/Inlet Needle and Seat	Section 4 and Group 24
EEC	Quick Test	Section 16
MCU	Component Diagnostics	Special MCU Diagnosis Manual
Fuel Delivery	Fuel Return Line Blocked	Group 24
Cooling	Thermostat	Group 27
Factors External to the Engine	Tire Pressure & Type Clutch Operation Automatic Transmission Shift Pattern and Fluid Level Brake Drag Exhaust System Speedometer/Odometer Gear Ratio Axle Ratio Vehicle Load Road & Weather Conditions	Manual and Visual
Ignition Timing	Base plus Advance and Retard Functions	Section 15

CA5641-E

214	HIGH OIL CONSUMPTION	
System	**Component**	**Reference**
External Leaks		Visual
Proper Dipstick	Overfilling (sometimes accomplished by the "short stick" gas station procedure).	Manual and Visual
Induction	Air Cleaner Element (Sealing)	Visual and Group 24
PCV	Valve	Section 9
Turbocharger	Compressor/Turbine Bearing, Seals, Center Drain, Etc.	Visual and Group 24
Internal Leaks (blue smoke from tailpipe)	Valve Guides Valve Stem Seals Intake Manifold and Gasket Cylinder Head Drain Passages Piston Rings	Group 21

If the condition cannot be verified, clean engine, if necessary, change oil and filter (at customer's expense), seal and have customer drive 804.5 Km (500 miles) or enough distance to consume two quarts before returning for re-examination.

CA5642-B

Diagnostic Routines

215	SPARK KNOCK/PINGING	
System	**Component**	**Reference**
EGR	Verify correct application, then diagnose.	Section 6
Induction	Air Cleaner Duct and Valve Assembly	Section 8
Vacuum Distribution	Vacuum Leaks Spark Delay Valve PVS	Visual, Audible, and Section 3
Basic Engine	Oil Level Compression Check Intake Manifold Gasket	Group 21
Cooling	Overheating	Routine 218
EEC	Quick Test	Section 16
MCU	Component Diagnostics	Special MCU Diagnosis Manual
Turbocharger		Group 24
Thermactor		Section 10
Ignition Timing	Initial plus Advance and Retard Functions	Section 15

If the above fails to correct the condition, it is recommended that the owner change his source of fuel and use higher octane fuel. **CA5643-E**

216	ENGINE VIBRATES AT NORMAL SPEEDS	
System	**Component**	**Reference**
Engine Accessories	Fan Belt Driven Components Engine Mounts Engine Vibration Damper	Manual and Visual
Otherwise	Non-Engine Components: Drive Line, Tires, Wheel Balance	Manual and Visual

CA6348-B

217	ENGINE RUNS COLD	
System	**Component**	**Reference**
Gauge System	Gauge, Sender	Group 33
Cooling	Thermostat	Group 27

CA6349-B

Diagnostic Routines

218	ENGINE RUNS HOT	
System	**Component**	**Reference**
Cooling	Coolant Level Radiator or A/C Condenser Pressure Cap and Overflow System External Leaks Belts and Belt Tension Fan and Fan Clutch Electric Fan (If So Equipped)	Visual Group 27
Gauge System	Gauge, Sender	Group 33
Cooling	Thermostat	Group 27
Ignition Timing	Base Plus Advance and Retard Functions	Section 15
Vacuum Distribution	Spark Delay Valve	Section 3
EEC	Quick Test	Section 16
MCU	Component Diagnostics	Special MCU Diagnosis Manual
Cooling	PVS	Section 3
Basic Engine	Oil Level Internal Leak(s) Core Sand in Head/Block Water Pump	Group 21
Brake	Brakes (dragging)	

CA5644-E

219	EXHAUST SMOKE	
Symptom	**Component**	**Reference**
Black Smoke (rich mixture)	Choke Plate and Linkage Cold Enrichment Rod and Linkage (7200)	Section 4 and Group 24
	Air Cleaner Element (Restricted)	Visual
	Internal Carburetor Components: Basic: Idle, Main and Accelerator Pump Metering Systems Enrichment Systems Fuel Inlet Needle/Seat Float	Visual, Section 4, and Group 24
	EEC Components	Section 16
	MCU Components	Special MCU Diagnosis Manual
Blue Smoke (burning oil)	PCV Valve	Section 9
	Valve Guides/Stems/Seals Oil Drain Passages in Head	Group 21
	Turbo Bearing Seals	Group 24
	Rings (not seated) Cylinder bores (scuffed)	Group 21
White Smoke (coolant in combustion)	Thermactor Vacuum Delay Valve (restricted) EGR Cooler Intake Manifold Cylinder Head/Gasket (leaks) Block (cracked/porous)	Section 3, Section 6, and Group 21

NOTE: White Smoke is normal during warm-up.

CA5645-E

Diagnostic Routines

220	GAS SMELL	
System	**Component**	**Reference**
Fuel Delivery	Fuel Filter (leaks) Fuel Line to Carburetor (leaks) Fuel Pump (leaks) Fuel Line, Pump to Tank (leaks) Fuel Tank (leaks) Fuel Tank Filler Neck/Cap (leaks) Fuel Return Line (Blocked)	Visual Section 11 and Group 24
Internal Carburetor/ Injectors	Float/Inlet Needle (stuck) Injectors (Leaking)	Section 3, Section 4, and Group 24
EVAP	Component (leaks)	Section 7 and Group 24

CA5646-D

221	"CHECK ENGINE" LIGHT ALWAYS ON OR NEVER ON	
System	**Component**	**Reference**
EEC	Component Diagnostic	Section 16
Some 1987 passenger cars are equipped with a light that alerts the driver to a malfunction in the engine control system.		

CA8485-A

SECTION 3

Emission Related Components

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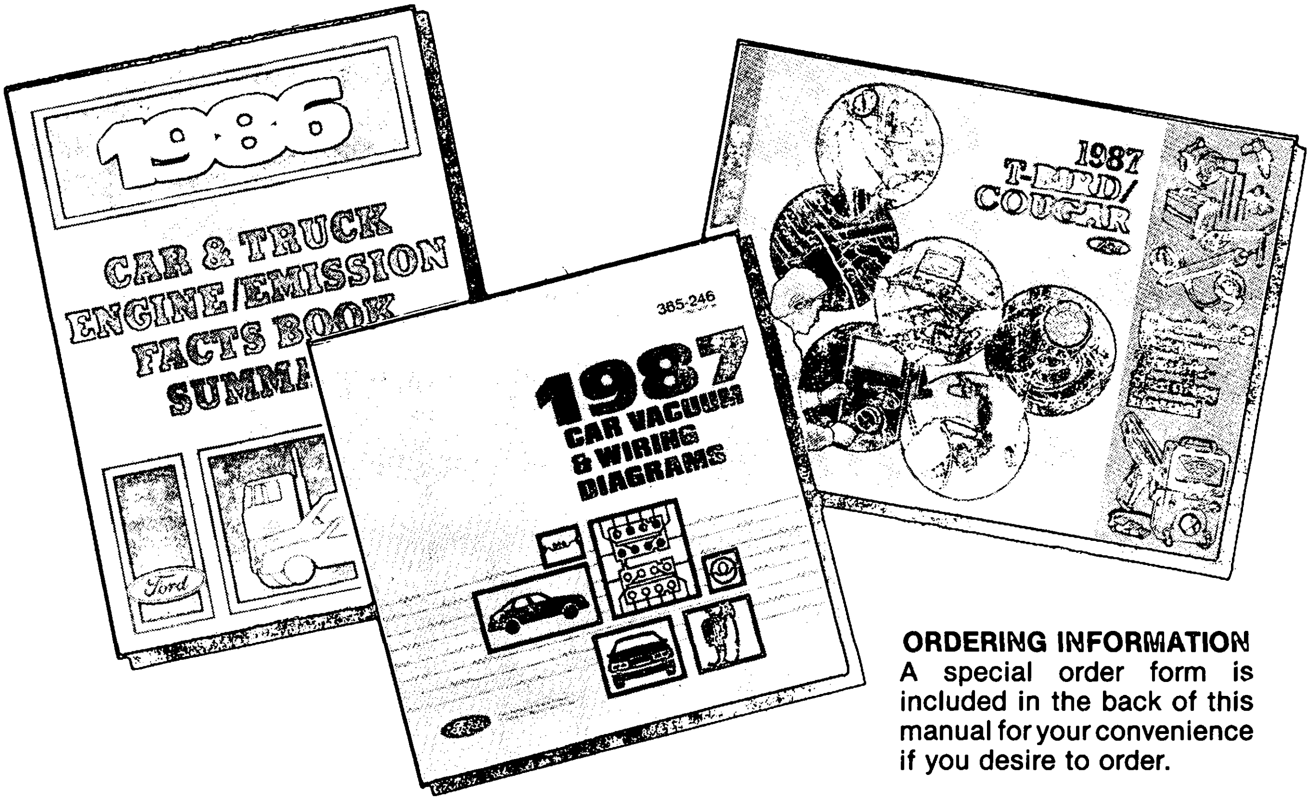
OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS



ORDERING INFORMATION
A special order form is included in the back of this manual for your convenience if you desire to order.

ENGINE EMISSIONS FACTS BOOK

- The manual contains complete specifications for each calibration number.
- Published at the conclusion of the model year.

ELECTRICAL & VACUUM TROUBLESHOOTING MANUAL (EVTM)

- Available for all passenger car and light truck vehicles, this publication provides schematics of all electrical and vacuum circuits. Wiring diagrams show how the circuit is powered. Troubleshooting hints are provided to point the technician in a general direction but are not step by step procedures.
- Available in the first quarter of the model year. (One manual for each passenger car and light truck family.)

WIRING & VACUUM DIAGRAMS

- This publication contains wiring diagrams for all Ford and Lincoln/Mercury passenger car and light truck vehicles. A Power Distribution system illustrates the power distribution throughout each vehicle. In addition, all individual electrical circuits are shown for each vehicle line.
- Available in the first quarter of the model year.

Service Specifications Manuals

(CAR AND TRUCK)

- These manuals contain all specifications including maintenance and lubrication contained in the Shop Manuals in a handy pocket size for easy reference.
- Available in the first quarter of the model year.

SECTION 3

Emission Related Components

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SECTION 3

Emission Related Components

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TITLE	BASIC PART NO.	SYMBOL
Air Bypass Valves	**9F715**	

DESCRIPTION

The air bypass solenoid is used to control engine idle speed and is operated by the Electronic Engine Control EEC module.

The valve allows air to pass around the throttle plates to control:

- Cold engine fast idle.
- No touch start.
- Dashpot.
- Over temperature idle boost.
- Engine idle load correction.

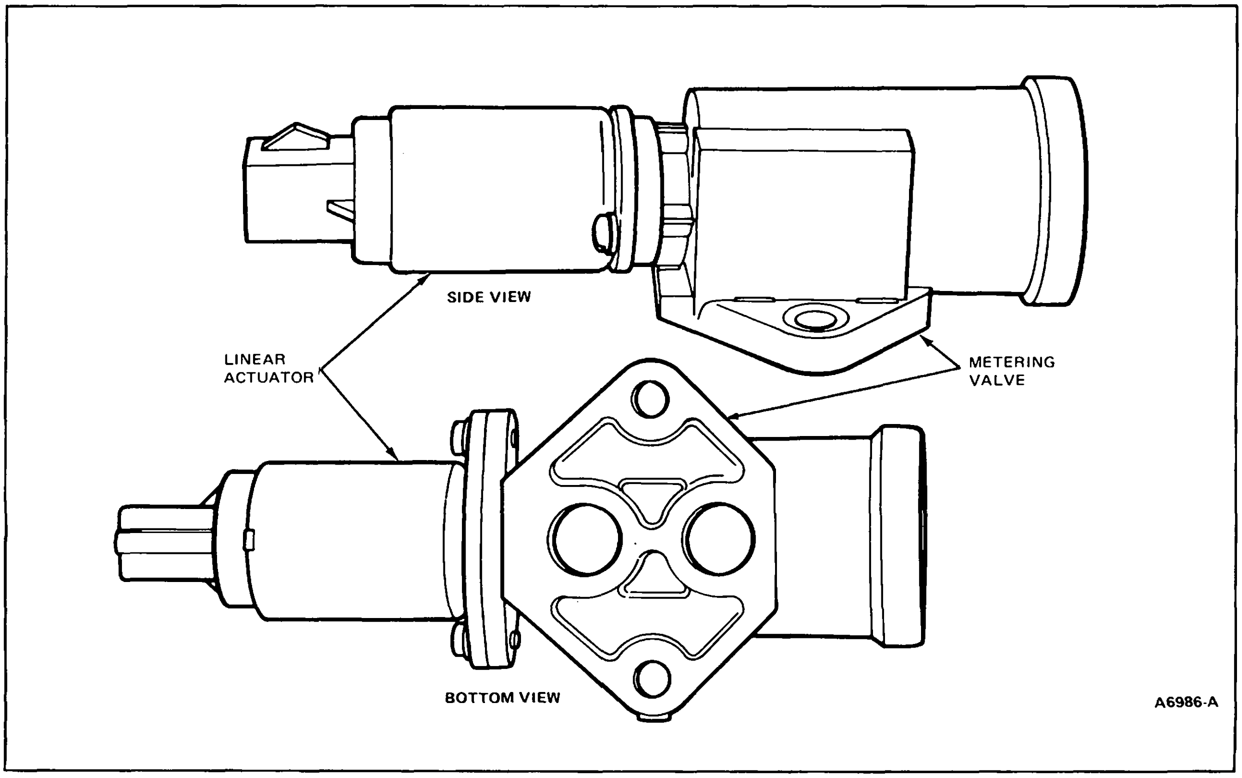
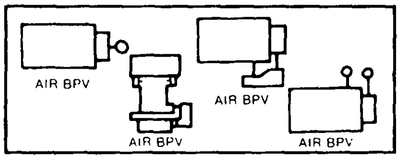


Figure 1 Air Bypass Valve Assembly

DIAGNOSIS

Refer to the EEC-IV Quick Test, Section 16.

TITLE	BASIC PART NO.	SYMBOL
Air Bypass Valves	**9B289**	

DESCRIPTION

There are two general groups of Air Bypass Valves, normally closed and normally open. Each group is available in remote (in-line) versions or pump-mounted (mounted directly on the air pump) versions (Figures 1, 2, and 3). The bypass valves are part of the Thermactor System, Section 10. Normally closed valves supply air to the exhaust system with medium and high applied vacuum signals during normal (engine at normal operating temperature) modes, short idles and some accelerations. With low or no vacuum applied the pump air is dumped through the silencer ports of the valve.

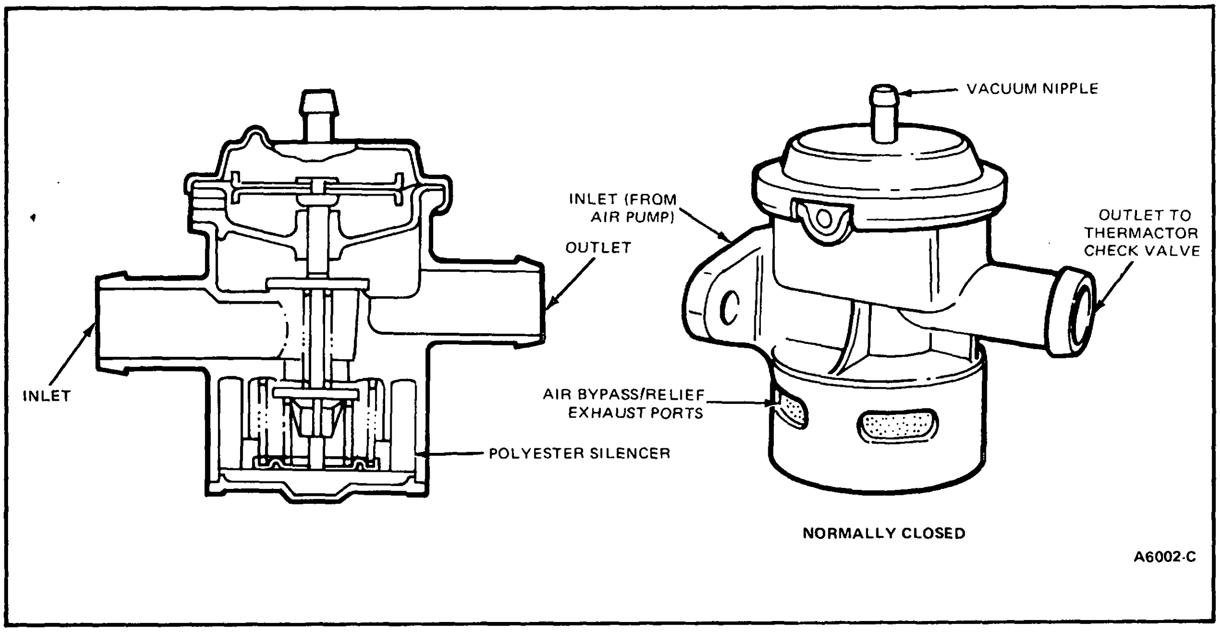
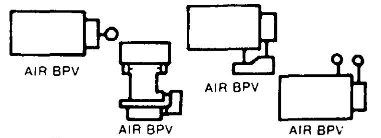


Figure 1 Normally Closed Air Bypass Valves

Normally Closed Bypass Valves (9B289)

Functional Check

1. Disconnect the air supply hose at the valve outlet.
2. Remove vacuum line to check to see that a vacuum signal is present at the vacuum nipple. Remove or bypass any restrictors or delay valves in the vacuum line. There must be a vacuum present at the nipple before proceeding.
3. With the engine at 1500 rpm and the vacuum line connected to the vacuum nipple, air pump supply air should be heard and felt at the air bypass valve outlet (Figure 1).
4. With the engine at 1500 rpm, disconnect the vacuum line. Air at the outlet should be significantly decreased or shut off. Air pump supply air should be heard or felt at the silencer ports.
5. If the normally closed air bypass valve does not successfully complete the above tests, check the air pump. If the air pump is operating satisfactorily, replace the air bypass valve.

TITLE	BASIC PART NO.	SYMBOL
Air Bypass Valves	**9B289**	

Normally Open Air Bypass Valves (9B289)

Normally open air bypass valves are available with or without vacuum vents. Test procedures differ for each.

Normally open valves with a vacuum vent provide a timed air dump during decelerations and also dump when a vacuum pressure difference is maintained between the signal port and the vent port. The signal port must have 10 kPa (3 in.-Hg.) more vacuum than the vent port to hold the dump. This mode is used to protect the catalyst from overheating.

Normally Open Air Bypass Valves with Vacuum Vents

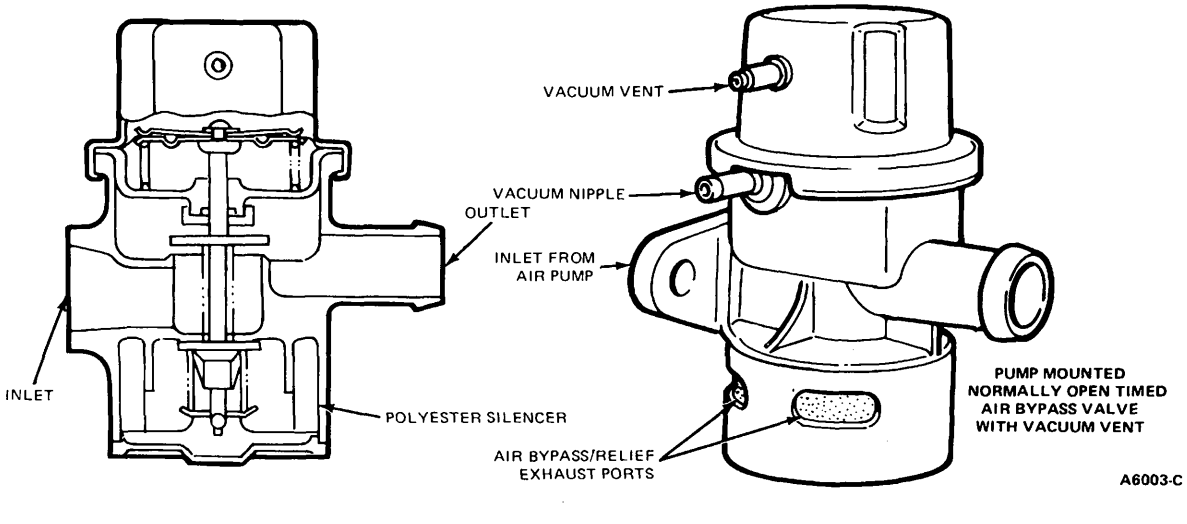
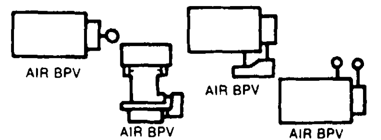

VACUUM VENT
VACUUM NIPPLE
OUTLET
INLET FROM AIR PUMP
INLET
POLYESTER SILENCER
AIR BYPASS/RELIEF EXHAUST PORTS
PUMP MOUNTED NORMALLY OPEN TIMED AIR BYPASS VALVE WITH VACUUM VENT
A6003-C

Figure 2 Normally Open Air Bypass Valves with Vacuum Vents

Functional Check

1. Disconnect the air pump supply line at the outlet.
2. Disconnect all vacuum lines from the vacuum nipple and the vacuum vent (Figure 2).
3. With the engine at 1500 rpm, air pump supply air should be heard and felt at the outlet (Figure 2).
4. Using a length of vacuum hose with no restrictors or devices, connect the vacuum nipple to one of the manifold vacuum fittings on the intake manifold. With the vacuum vent open to atmosphere and the engine at 1500 rpm, virtually no air should be felt at the valve outlet and virtually all air should be bypassed through the silencer ports.
5. Using the same direct vacuum line to an intake manifold vacuum source, cap the vacuum vent. Accelerate the engine to 2000 rpm, and suddenly release the throttle. A momentary interruption of air pump supply air should be felt at the valve outlet (Figure 2).
6. Reconnect all vacuum and thermactor lines. If any of the above tests are not satisfactorily completed, check the air pump. If the air pump is operating satisfactorily, replace the air bypass valve.

TITLE	BASIC PART NO.	SYMBOL
Air Bypass Valves	**9B289**	

Normally Open Air Bypass Valves without Vacuum Vent

Normally open valves without a vacuum vent provide a timed dump of air for 1.1 or 2.8 seconds when a sudden high vacuum of about 68 kPa (20 in.-Hg.) is applied to the signal port. This prevents backfire during deceleration.

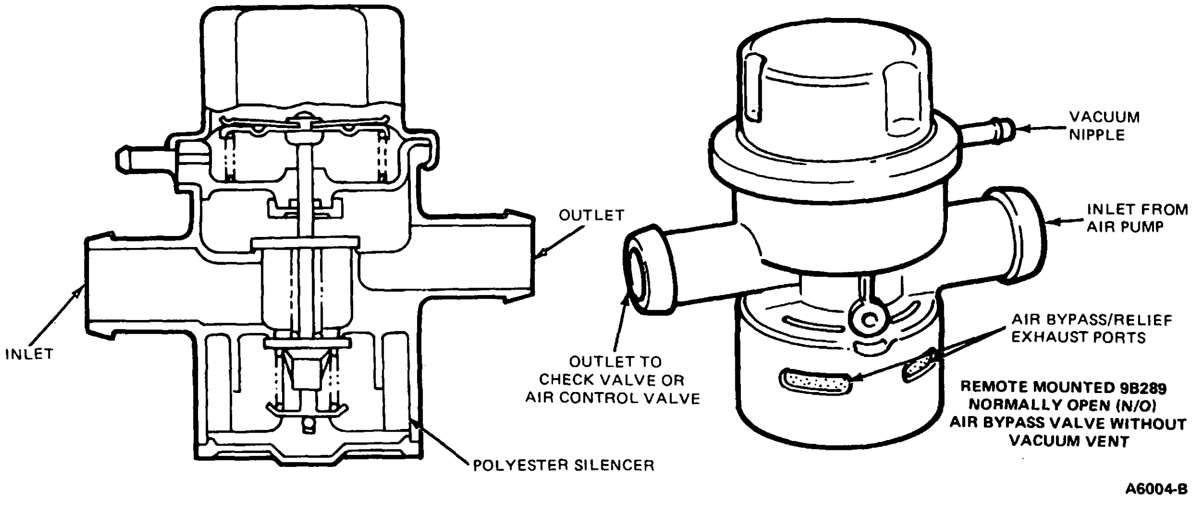
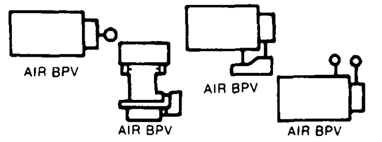

OUTLET
INLET
OUTLET TO CHECK VALVE OR AIR CONTROL VALVE
POLYESTER SILENCER
VACUUM NIPPLE
INLET FROM AIR PUMP
AIR BYPASS/RELIEF EXHAUST PORTS
REMOTE MOUNTED 9B289 NORMALLY OPEN (N/O) AIR BYPASS VALVE WITHOUT VACUUM VENT
A6004-B

Figure 3 Normally Open Air Bypass Valves Without Vacuum Vent (9B289)

Functional Check

1. Disconnect the air supply line at the valve outlet (Figure 3).
2. Disconnect the vacuum line at the vacuum nipple.
3. With the engine at 1500 rpm, air should be heard and felt at the valve outlet.
4. Connect a direct vacuum line that is free from restrictions from any manifold vacuum source to the vacuum nipple on the air bypass valve. Air at the outlet should be momentarily decreased or shut off.
5. Air pump supply air should be heard or felt at silencer ports (Figure 3) during the momentary dump. Restore all original connections. If any of the above tests are not satisfactorily completed, check the air pump. If the air pump is operating satisfactorily, replace the air bypass valve.

TITLE	BASIC PART NO.	SYMBOL
Air Bypass Valves	**9B289**	

Normally Open Air Bypass Valves without Vacuum Vent

Heavy Truck Applications

Normally open valves without a vacuum vent provide a timed dump of air for 2 seconds nominal when a sudden high vacuum of about 68 kPa (20 in.-Hg.) is applied to the signal port. This prevents backfire during deceleration.

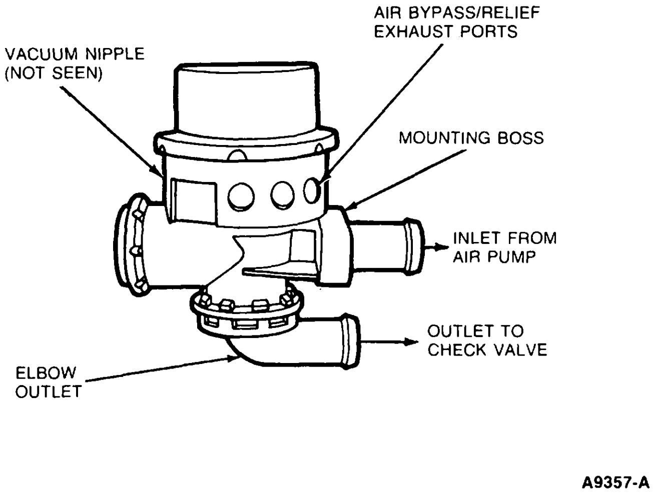
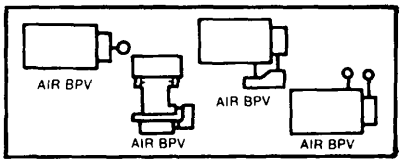


Figure 4 Normally Open Without Vacuum Vent

Functional Check

1. Disconnect the air supply line at the valve outlet (Figure 4).
2. Disconnect the vacuum line at the vacuum nipple.
3. With the engine at 1500 rpm, air should be heard and felt at the valve outlet.
4. Connect a direct vacuum line that is free from restrications from any manifold vacuum source to the vacuum nipple on the air bypass valve. Air at the outlet should be momentarily decreased or shut off.
5. Air pump supply air should be heard or felt at silencer ports (Figure 4) during the momentary dump. Restore all original connections. If any of the above tests are not satisfactorily completed, check the air pump. If the air pump is operating satisfactorily, replace the air bypass valve.

TITLE	BASIC PART NO.	SYMBOL
Air Bypass Valves	**9B289**	

Normally Open Air Bypass Valves (9B289)—Heavy Truck Application

Normally open valves with a vacuum vent provide a timed air dump decelerations and also dump when a vacuum pressure difference is maintained between the signal port and the vent port. The signal port must have 10 kPa (3 in.-Hg.) more vacuum than the vent port to hold the dump. This mode is used to protect the catalyst from overheating.

Normally Open Air Bypass Valves with Vacuum Vents

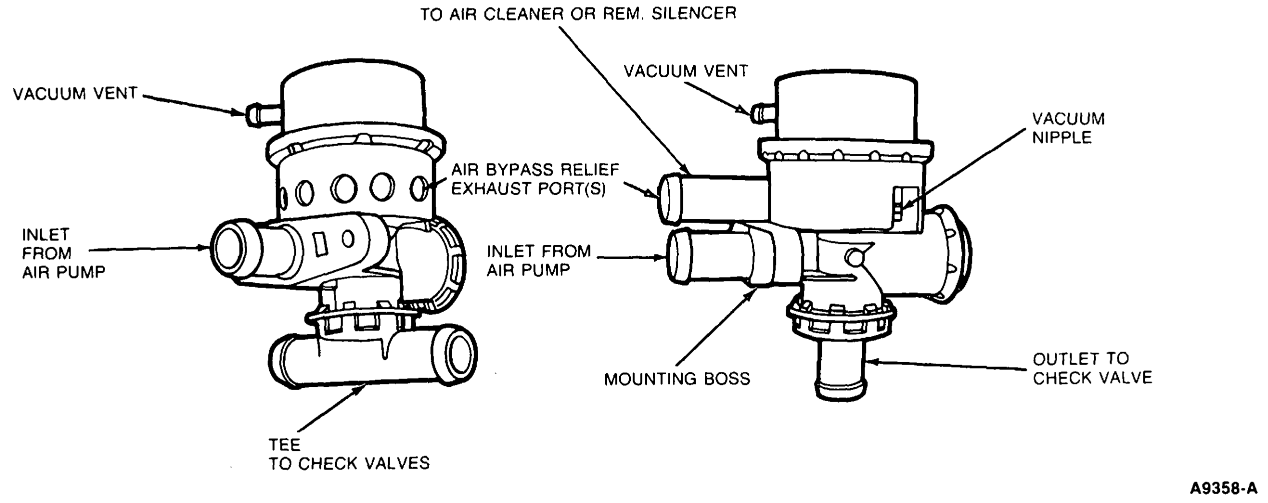


Figure 5 Normally Open Air Bypass Valves

Functional Check

1. Disconnect the air supply line at the valve outlet (Figure 5) and relief port if applicable.
2. Disconnect the vacuum line at the vacuum nipple.
3. With the engine at 1500 rpm, air should be heard and felt at the valve outlet.
4. Connect a direct vacuum line that is free from restrictions from any manifold vacuum source to the vacuum nipple on the air bypass valve. Air at the outlet should be momentarily decreased or shut off.
5. Air pump supply air should be heard or felt at silencer ports (Figure 5) during the momentary dump. Restore all original connections. If any of the above tests are not satisfactorily completed, check the air pump. If the air pump is operating satisfactorily, replace the air bypass valve.

TITLE	BASIC PART NO.	SYMBOL
Air Charge Temperature Sensor	**12A697**	

DESCRIPTION

The sensor provides the Electronic Fuel Injection System with mixture (fuel and air) temperature information. The ACT is used both as a density corrector to airflow calculation and to proportion the cold enrichment fuel flow. This sensor is similar in construction to the Engine Coolant Temperature (ECT) sensor, except it is packaged to improve sensor response time.

The sensor is threaded into a cylinder runner of the intake manifold and provides the fuel strategy with mixture temperature information. The sensor input is used as a density corrector for airflow calculations and to proportion the cold enrichment fuel flow.

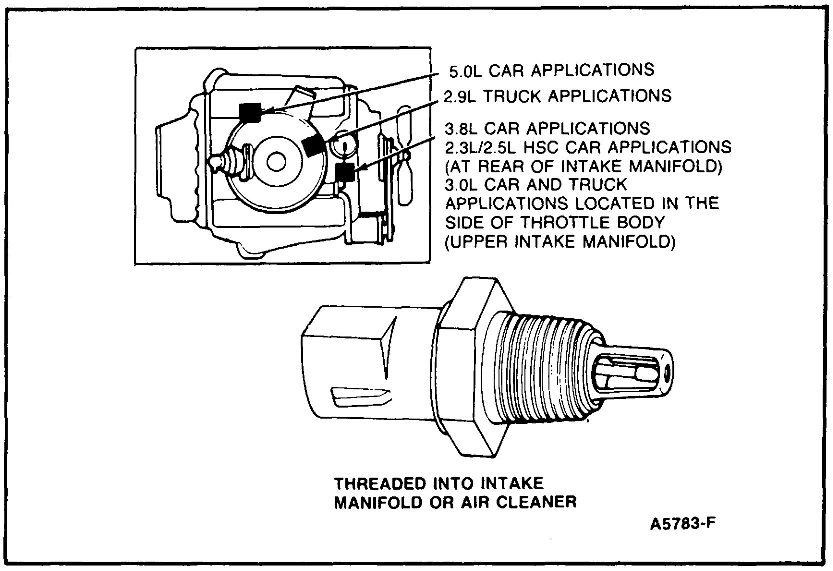

5.0L CAR APPLICATIONS
2.9L TRUCK APPLICATIONS
3.8L CAR APPLICATIONS
2.3L/2.5L HSC CAR APPLICATIONS (AT REAR OF INTAKE MANIFOLD)
3.0L CAR AND TRUCK APPLICATIONS LOCATED IN THE SIDE OF THROTTLE BODY (UPPER INTAKE MANIFOLD)
THREADED INTO INTAKE MANIFOLD OR AIR CLEANER
A5783-F

Figure 1 ACT (Air Charge Temperature) Sensor

DIAGNOSIS

Refer to the EEC-IV Quick Test, Section 16.

TITLE	BASIC PART NO.	SYMBOL
Air Check Valve/ Pulse Air Valve	**9A487 9B449**	

DESCRIPTION

The Air Check Valve (Figure 1) is a one-way valve that allows thermactor air to pass into the exhaust system while preventing exhaust gases from passing in the opposite direction.

The Pulse Air Valve (Figure 2) replaces the air pump application in some thermactor systems. It permits air to be drawn into the exhaust system on vacuum exhaust pulses and blocks the backflow of high pressure exhaust pulses. The fresh air completes the oxidation of exhaust gas components.

NOTE: Although the two valves share the same basic part number and have the same appearance, they are NOT INTERCHANGEABLE.

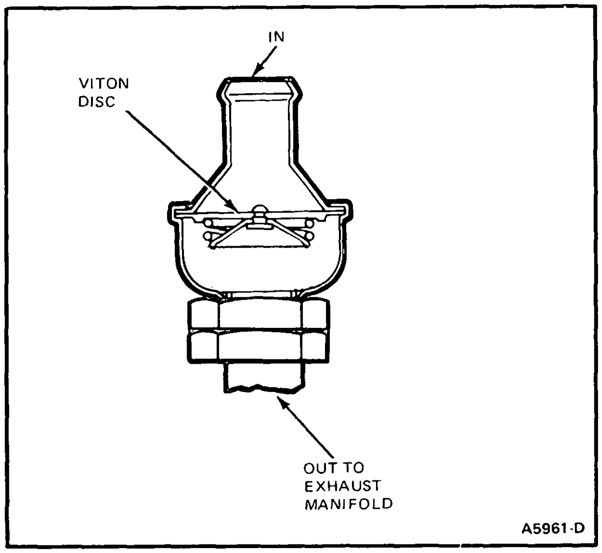


Figure 1 Air Check Valve

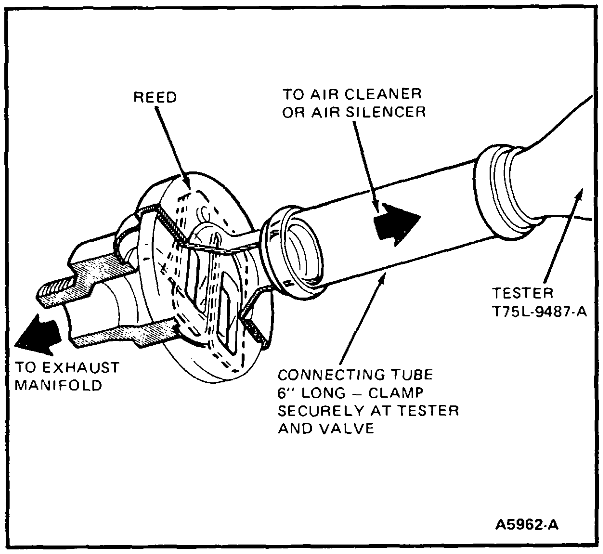

REED
TO AIR CLEANER OR AIR SILENCER
TESTER T75L-9487-A
TO EXHAUST MANIFOLD
CONNECTING TUBE 6" LONG – CLAMP SECURELY AT TESTER AND VALVE
A5962-A

Figure 2 Pulse Air Valve (Thermactor II)

Functional Check

1. Inspect all hoses, tubes and the air valve for leaks.
2. Disconnect the hose on the inlet side of the air valve, and connect the check valve tester T75L-9487-A or equivalent as shown in Figure 2. Note that a 6-inch length of tube, securely clamped, should be used between the valve and the tester.
3. Squeeze the rubber bulb on the tester as flat as possible, then release it. The bulb should remain creased for 8 seconds and should not return to a normal shape until after 15 seconds.

   If the above tester is not available, blow through the check valve, toward manifold, then attempt to suck back through the valve; the valve should free flow in the direction of the exhaust manifold only.
4. **For the pulse air valve only:** after starting the engine and at curb idle, a suction should be felt at the valve inlet. If not, replace the valve.

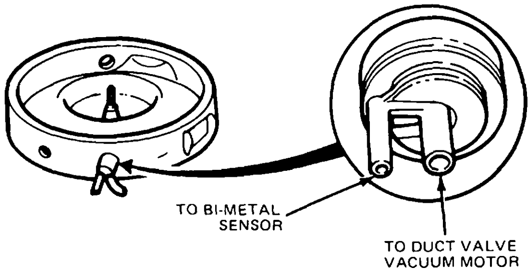
NOTE: Refer to Section 10 for a description of the Thermactor System.

TITLE	BASIC PART NO.	SYMBOL
Air Cleaner Cold Weather Modulator	**9E862**	A/CL CWM

DESCRIPTION

A cold weather modulator is some times used in addition to the air cleaner temperature control (bi-metal) sensor to control the inlet air temperature.

The cold weather modulator traps vacuum in the system, so the door will not switch to cold air when the vacuum drops during acceleration. The cold weather modulator only works when the outside air is cold, (refer to the chart below).



A5918-A

Figure 1 Cold Weather Modulator

DIAGNOSIS

A 54 kPa (16 in.-Hg.) vacuum applied to motor side of the modulator holds or leaks as follows:

COLOR	TYPE	HOLDS	LEAKS
Black	N/O	Below -6.7°C (20°F)	Above 1.7°C (35°F)
Blue	N/O	Below 4.4°C (40°F)	Above 12.8°C (55°F)
Green	N/O	Below 10°C (50°F)	Above 24.4°C (76°F)
Yellow	N/C	Above 18.3°C (65°F)	Below 10°C (50°F)

CA6833-A

TITLE	BASIC PART NO.	SYMBOL
Air Cleaner Temperature Sensor	**9E607**	○ A/CL BIMET

DESCRIPTION

The sensor is installed in the cleaner tray and is subjected to temperature changes within the air cleaner. At a given increase in temperature, the sensor bleeds off vacuum, permitting the vacuum motor to open the duct door to allow fresh air in while shutting off full heat.

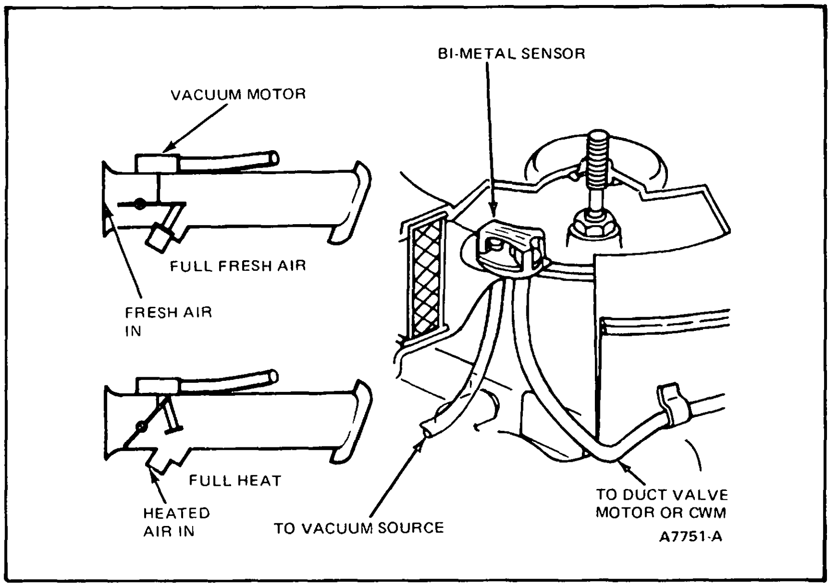


Figure 1 Air Cleaner Temperature Sensor

DIAGNOSIS

At an ambient temperature of less than 24 °C (75 °F), the sensor will allow vacuum to close the duct door to fresh air. The sensor will bleed off vacuum to allow the duct door to open and let in fresh air at or above the following temperatures:

Brown	24 °C (75 °F)
Pink, black, or clear	32.2 °C (90 °F)
Blue, yellow or green	40.6 °C (105 °F)

TITLE	BASIC PART NO.	SYMBOL
Air Cleaner Vacuum Motor	**9D604**	

DESCRIPTION

The air cleaner vacuum motor operates the door within the duct, which allows either warm or cold air to enter the engine, depending upon the temperature within the air cleaner.

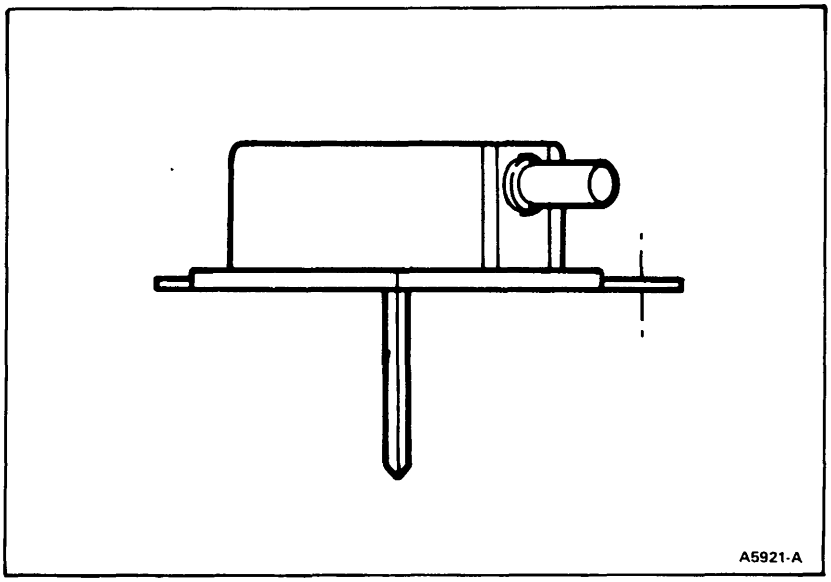
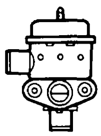


Figure 1 Air Cleaner Vacuum Motor

DIAGNOSIS

When a vacuum of 27 kPa (8 in.-Hg.) or greater is applied to the vacuum motor, the door stem should pull up and stay as long as vacuum is applied to the vacuum motor.

TITLE	BASIC PART NO.	SYMBOL
Air Control Valve (Switch-Relief)	**9F491**	

DESCRIPTION

The Air Supply Control Valve is used in the Thermactor (secondary air) System.

The air control valve directs air pump output to the exhaust manifold or downstream to the catalyst system depending upon the engine control strategy. A pressure relief valve also provides air pump protection in the event of excessive exhaust backpressure or system blockage.

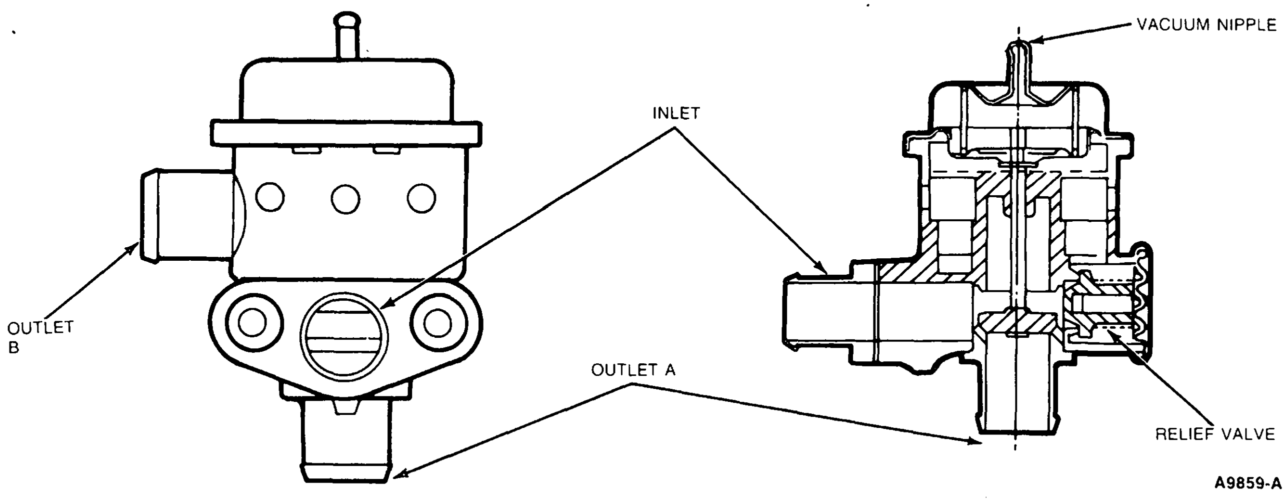


Figure 1 Air Control Valve (Switch-Relief)

Functional Check

1. Verify that airflow is being supplied to the valve inlet by disconnecting the air supply hose at the inlet and verifying the presence of airflow with the engine at 1500 rpm. Reconnect the air supply hose to the valve inlet.
2. Disconnect the air supply hoses at outlets A and B (Figure 1).
3. Remove the vacuum line at the vacuum nipple.
4. Accelerate the engine to 1500 rpm. Airflow should be heard and felt at outlet B with little or no airflow at outlet A (Figure 1).
5. With the engine at 1500 rpm, connect a direct vacuum line from any manifold vacuum fitting to the air control valve vacuum nipple. Airflow should be heard and felt at outlet A with little or no airflow at Outlet B.
6. Restore all connections. If conditions above are not met, replace the air control valve.

TITLE	BASIC PART NO.	SYMBOL
Air Silencer	**9G427** **9H467**	SILN

DESCRIPTION

The Air Silencer is a combination silencer and filter for air supply pumps that are not equipped with an impeller type centrifugal air filter fan or for pulse air (Thermactor II) systems. The air silencer is mounted in a convenient position in the engine compartment and is connected to the air supply pump or pulse air valve inlet by means of a flexible hose.

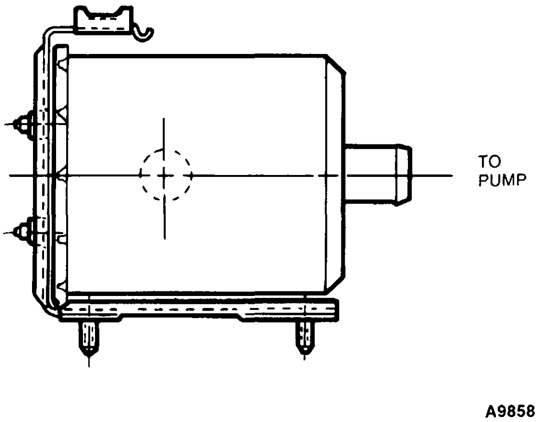


Figure 1 Air Silencer - 9H467, Typical

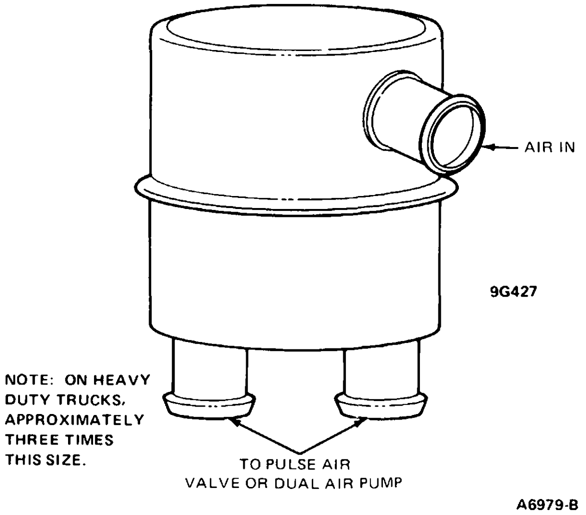
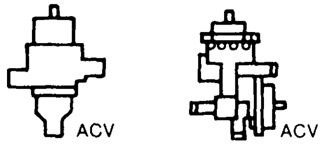

AIR IN
9G427
NOTE: ON HEAVY DUTY TRUCKS, APPROXIMATELY THREE TIMES THIS SIZE.
TO PULSE AIR VALVE OR DUAL AIR PUMP
A6979-B

Figure 2 Air Silencer - 9G427, Typical

Functional Check

1. Inspect hoses and air silencer for leaks.
2. Disconnect hose from air silencer outlet, remove silencer and visually inspect for plugging.
3. The air silencer is operating satisfactorily if no plugging or leaks are encountered.

TITLE	BASIC PART NO.	SYMBOL
Air Supply Control Valves	**9F491**	

DESCRIPTION

The Air Supply Control Valve is used in the Thermactor (secondary air) System.

The air control valve directs air pump output to the exhaust manifold or downstream to the catalyst system depending upon the engine control strategy.

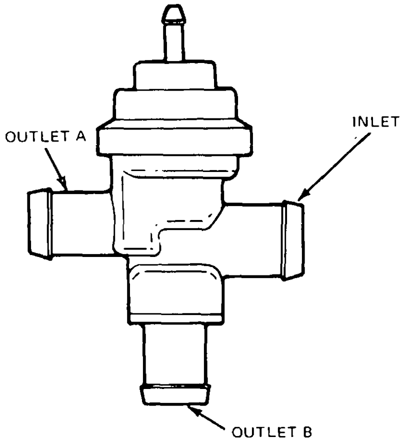


Figure 1 Standard Air Control Valve

Functional Check

1. Verify that airflow is being supplied to the valve inlet by disconnecting the air supply hose at the inlet and verifying the presence of airflow with the engine at 1500 rpm. Reconnect the air supply hose to the valve inlet.
2. Disconnect the air supply hose at outlets A and B (Figure 1).
3. Remove the vacuum line at the vacuum nipple.
4. Accelerate the engine to 1500 rpm. Airflow should be heard and felt at outlet B with little or no airflow at outlet A (Figure 1).
5. With the engine at 1500 rpm, connect a direct vacuum line from any manifold vacuum fitting to the air control valve vacuum nipple. Airflow should be heard and felt at outlet A with little or no airflow at outlet B.
6. If the valve is the bleed type, less air will flow from outlet A or B, and the main discharge will change when vacuum is applied to the vacuum nipple.
7. Restore all connections. If conditions above are not met, replace the air control valve.

TITLE	BASIC PART NO.	SYMBOL
Air Supply Pump	**9A486**	

DESCRIPTION

Passenger Cars and Light Trucks

The Air Supply Pump is a belt driven, positive displacement, vane type pump that provides air for the Thermactor system. It is available in 11-cubic inch and 19-cubic inch sizes, either of which may be driven with different pulley ratios for different applications. The 11-cubic inch pump (Figure 1) receives its air through a remote filter attached to the air inlet nipple or through an impeller type centrifugal air filter fan. The 19-cubic inch pump (Figure 2) uses an impeller type centrifugal air filter fan which separates dirt, dust, and other contaminants from the intake air by centrifugal force. The air supply pump does not have a pressure relief valve, a function performed by the bypass valve. A description of the Thermactor System is in Section 10.

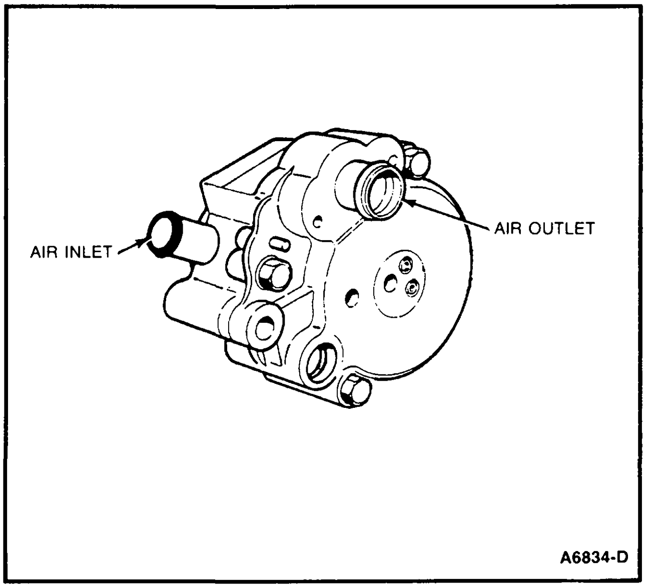


Figure 1 11-Cubic Inch Thermactor Air Supply Pump

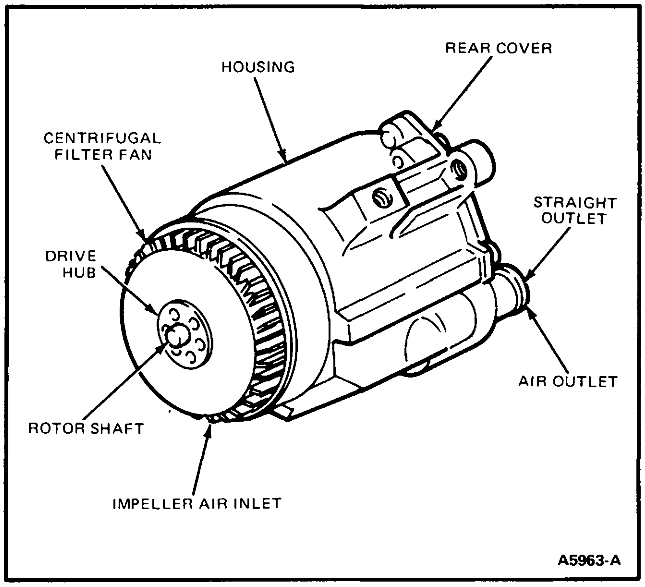


Figure 2 19-Cubic Inch Thermactor Air Supply Pump

Functional Check

1. Check belt tension, and adjust to specifications.
2. Disconnect air supply hose from bypass control valve.
3. The pump is operating satisfactorily if air flow is felt at the pump outlet and the flow increases as the engine speed is increased.

Do not pry on the pump to adjust belt. The aluminum housing is likely to collapse.

TITLE	BASIC PART NO.	SYMBOL
Air Supply Pump	**9A486**	

DESCRIPTION

Heavy Duty Trucks

Th Air Supply Pump is a belt driven, positive displacement, vane type pump that provides air for the Thermactor system. It is available in 19-cubic inch and 23-cubic inch sizes, either of which may be driven with different pulley ratios for different applications. Both pumps (Figure 3), receive air from a remote silencer filter attached to the pumps' air inlet nipple. The pressure relief function is performed by the bypass valve. A description of the Thermactor System is in Section 10.

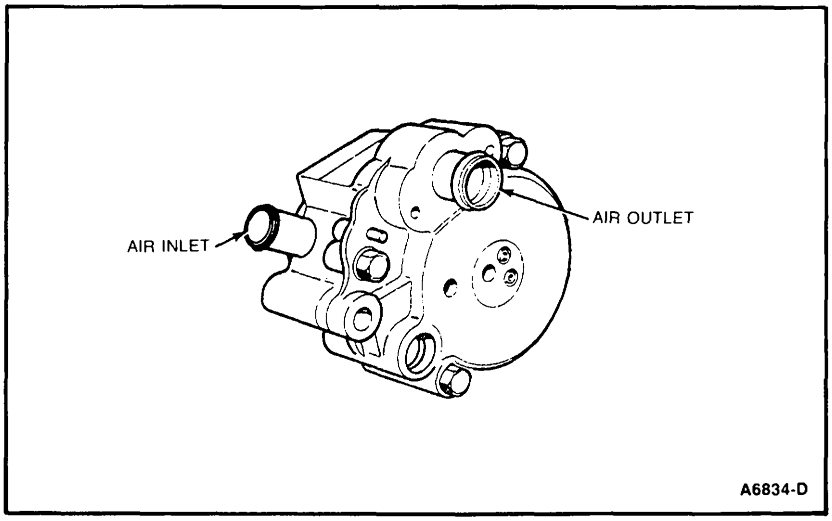


Figure 3 19, 22 and 23 Cubic Inch Thermactor Air Supply Pump

Functional Check

1. Check belt tension, and adjust to specifications.
2. Disconnect air supply hose from bypass control valve.
3. The pump is operating satisfactorily if airflow is felt at the pump outlet and the flow increases as the engine speed is increased.

Do not pry on the pump to adjust belt. The aluminum housing is likely to collapse.

TITLE	BASIC PART NO.	SYMBOL
Air Throttle Body Assembly	**9E926**	

DESCRIPTION

The Throttle Body Assembly, (Figure 1) controls airflow to the engine via a single or dual butterfly valve. The throttle position is controlled by conventional linkage. The body is a single-piece, die casting of aluminum. It has a single bore with an air bypass channel around the throttle plate.

Other features of the air throttle body assembly include:

1. an adjustment screw to set the throttle plate at a minimum idle airflow position,
2. a pre-set stop to locate the wide-open throttle (WOT) position,
3. a throttle body mounted throttle position sensor,
4. a PCV fresh air source upstream of the throttle plate (some applications),
5. individual vacuum taps (some applications) for PCV and EGR control signals.
6. idle air bypass valve.

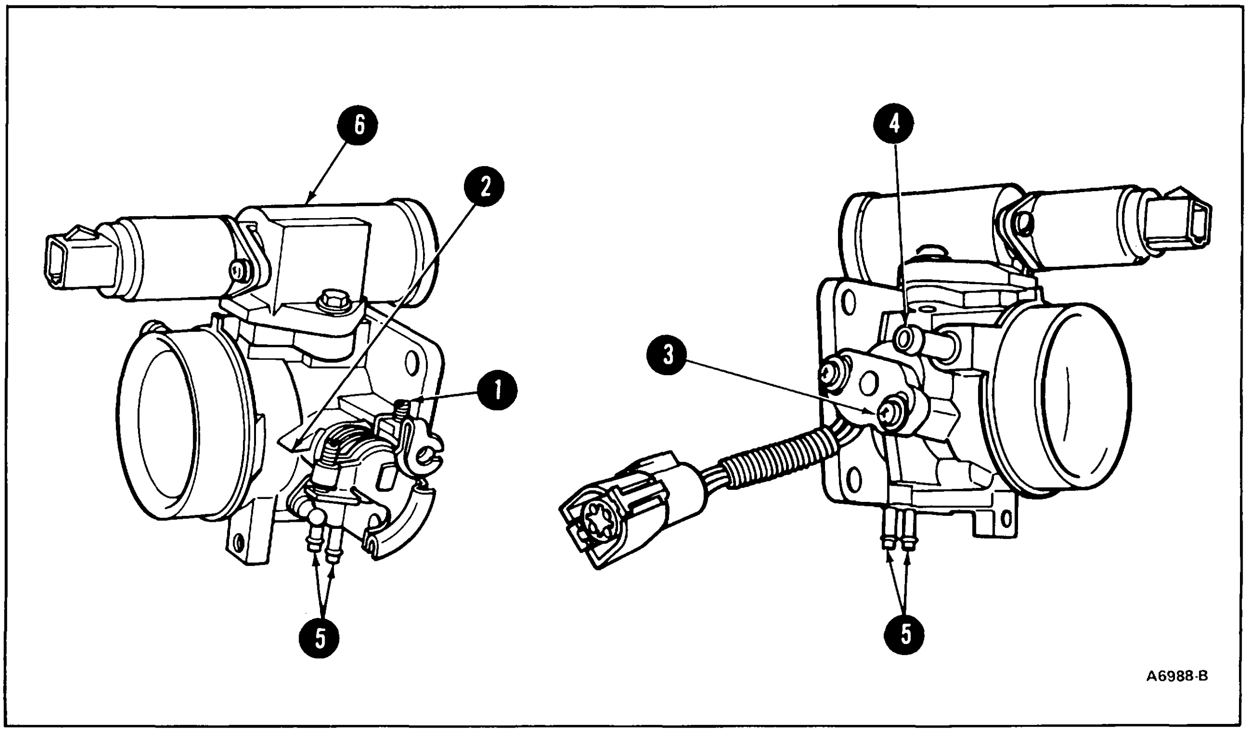
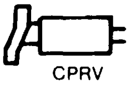


Figure 1 Air Throttle Body Assembly

TITLE	BASIC PART NO.	SYMBOL
Canister Purge Regulator Valve	**9C915**	

DESCRIPTION

The canister purge solenoid is part of the Evaporative Emission Control System, Section 7 and is used with the Electronic Engine Control (EEC).

This valve controls the flow of vapors from the carbon canister to the intake manifold during various engine operating modes. This valve controls carbon canister purging.

This is a normally closed valve that is opened by a signal from the electronic control assembly (ECA).

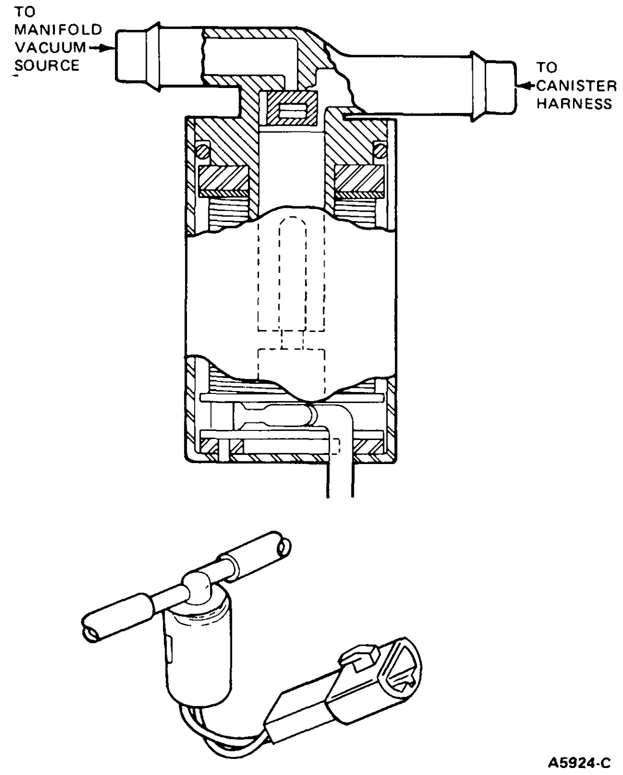


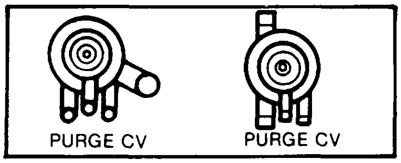
Figure 1 Canister Purge Regulator Valve

DIAGNOSIS

With valve de-energized, apply 5 in.-Hg. to "vacuum source" port, valve should not pass air; if it does, replace valve.

While applying 9-14 volts DC to valve, the valve will open and pass air. If it does not, replace valve.

NOTE: The Evaporative Emission System is discussed in Section 7.

TITLE	BASIC PART NO.	SYMBOL
Canister Purge Valve	**9B963**	

DESCRIPTION

The Canister Purge Valve is part of the Evaporative Emission Control System, Section 7.

The valve, Figure 1, is in-line with the carbon canister and controls the flow of vapors from the canister to the engine.

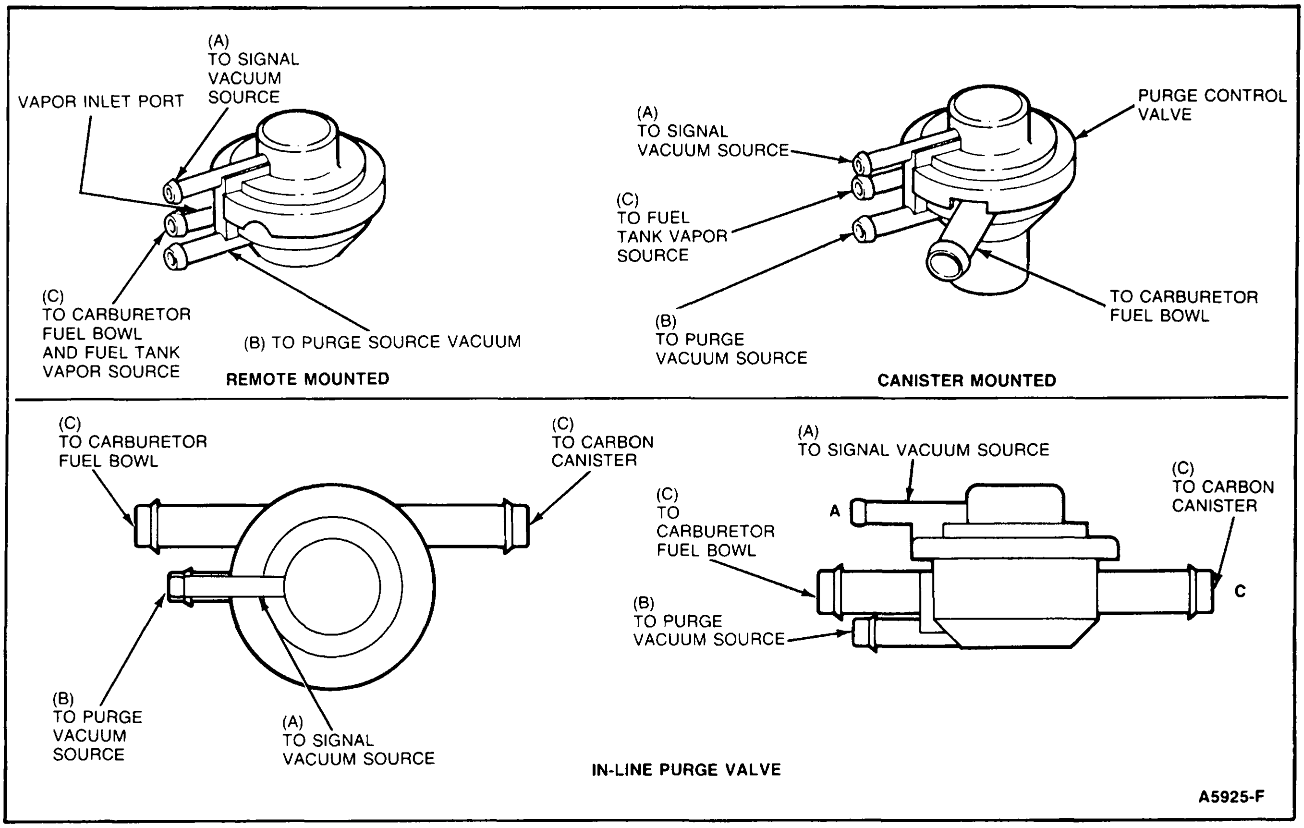

(A) TO SIGNAL VACUUM SOURCE
VAPOR INLET PORT
(C) TO CARBURETOR FUEL BOWL AND FUEL TANK VAPOR SOURCE
(B) TO PURGE SOURCE VACUUM
REMOTE MOUNTED
(A) TO SIGNAL VACUUM SOURCE
PURGE CONTROL VALVE
(C) TO FUEL TANK VAPOR SOURCE
(B) TO PURGE VACUUM SOURCE
TO CARBURETOR FUEL BOWL
CANISTER MOUNTED
(C) TO CARBURETOR FUEL BOWL
(C) TO CARBON CANISTER
(B) TO PURGE VACUUM SOURCE
(A) TO SIGNAL VACUUM SOURCE
(A) TO SIGNAL VACUUM SOURCE
A
(C) TO CARBON CANISTER
(C) TO CARBURETOR FUEL BOWL
C
(B) TO PURGE VACUUM SOURCE
IN-LINE PURGE VALVE
A5925-F

Figure 1 Purge Control Valve

DIAGNOSIS

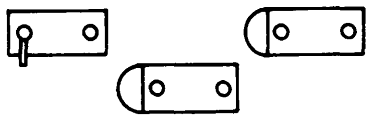
Application of vacuum to Port A (only) should indicate no flow. If flow occurs, replace valve.

Application of vacuum to Port B (only) should indicate no flow, valve should be closed (all valves except E5VE-AA, E4VE-AA, E77E-AA, which should indicate slight flow). If valve flows (except E5VE-AA, E4VE-AA, E77E-AA), replace valve.

After applying and maintaining 54 kPa (16 in.-Hg.) vacuum to Port A, apply vacuum to Port B. Air should pass. (Note: Valves E5VE-AA, E4VE-AA, E77E-AA should indicate higher flow than that indicated in above test.)

Important: Never apply vacuum to Port(s) C. Doing so may dislodge internal diaphragm and valve will be permanently damaged.

NOTE: The Evaporative Emission System is discussed in Section 7.

TITLE	BASIC PART NO.	SYMBOL
Carbon Canister	**9D653**	

DESCRIPTION

The fuel vapors from the fuel tank and carburetor fuel bowl are stored in the carbon canister until the vehicle is operated, at which time, the vapors will purge from the canister into the engine for consumption. There are two canister sizes, 925 ml and 1400 ml carbon. Canisters are sometimes used in pairs when the vehicle has a large fuel tank, or dual fuel tanks or dual carburetor bowls.

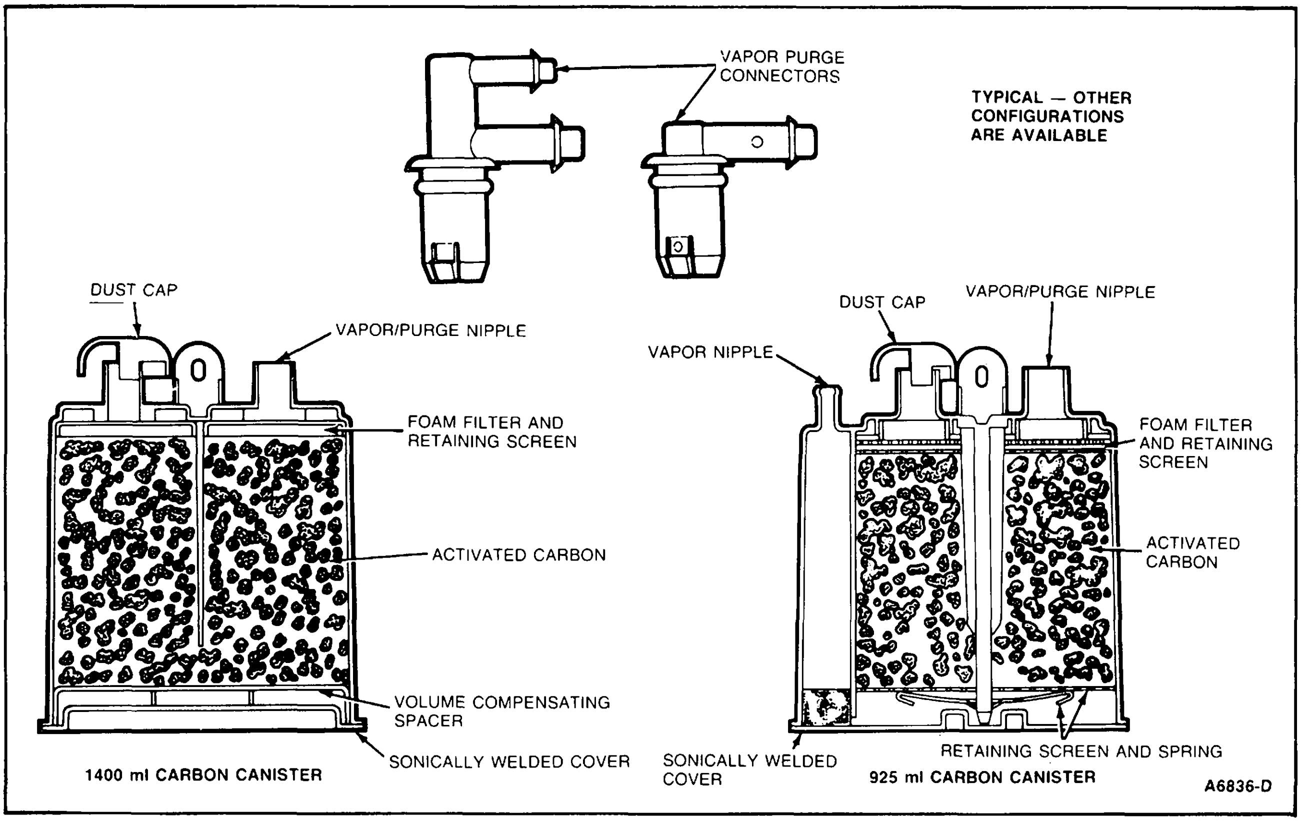


Figure 1 Carbon Canisters

DIAGNOSIS

There are no moving parts and nothing to wear in the canister.
Check for loose, missing, cracked, or broken connections and parts.

The Evaporative Emission System is discussed in Section 7.

TITLE	BASIC PART NO.	SYMBOL
Carburetor Fuel Bowl Solenoid Vent Valve	**9B982**	SV-CBV

DESCRIPTION

The Fuel Bowl Vent Solenoid Valve, Figure 1, is part of the Evaporative Emission Control System, Section 7 and is a normally open valve located in the fuel bowl vent line. The vent solenoid valve closes off the fuel bowl vent line when the engine is running, and it returns to the normally open condition when the ignition switch is turned off.

NOTE: If lean fuel mixture is suspected as the cause of a problem, Inspect the bowl vent solenoid valve for proper closing during engine operation. If the valve leaks or does not close, the carburetor will give an incorrect air/fuel mixture.

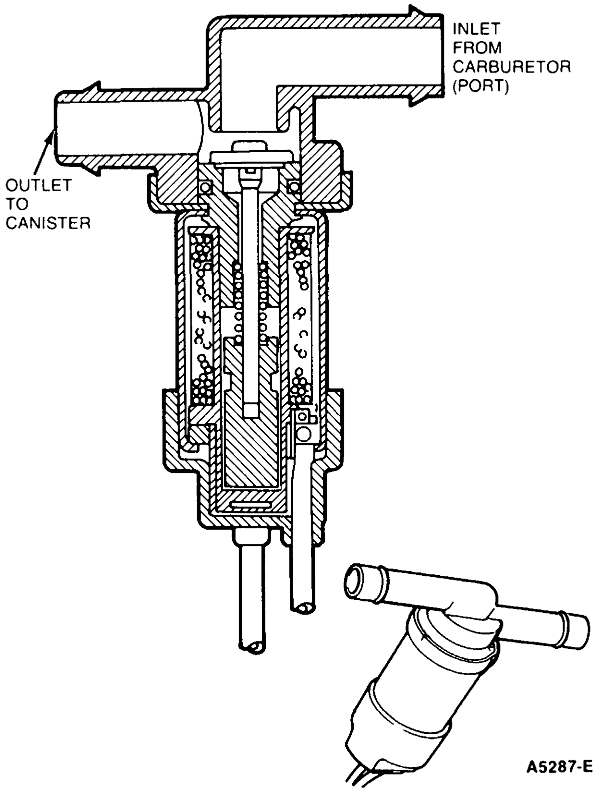


Figure 1 Fuel Bowl Vent Solenoid Valve

DIAGNOSIS

Apply 9-14 volts DC to valve, the valve should close, not allowing air to pass. If valve does not close or leaks when voltage and 1 in.-Hg. vacuum is applied to carburetor port, replace the valve.

NOTE: The Evaporative Emission System is discussed in Section 7.

TITLE	BASIC PART NO.	SYMBOL
Carburetor Fuel Bowl Thermal Vent Valve	**9E589**	 TVV

DESCRIPTION

Fuel Bowl Thermal Vent Valve

The Thermal Vent Valve, Figure 1, is a temperature actuated closed-to-flow/open-to-flow valve. It is inserted in the carburetor-to-canister vent line and is closed when the engine compartment is cold. This prevents fuel tank vapors (generated when the fuel tank heats up before the engine compartment does) from being vented through the carburetor fuel bowl—forcing them instead into the carbon canister.

This effect can occur, for instance, when sunlight strikes a vehicle which has been sitting out all night, and begins to warm the fuel tank. With the thermal vent valve closed, the vapors cannot enter the carburetor fuel bowl vent valve (now closed) but must be routed to the carbon canister. As the engine compartment warms up, during normal engine operation, the thermal vent valve opens. When the engine is again turned off, the thermal vent valve (now open because underhood temperature is above 120°F) allows fuel vapors generated from the carburetor float bowl to pass through the valve and store themselves in the carbon canister. As the thermal vent valve cools, it again closed and the cycle begins again.

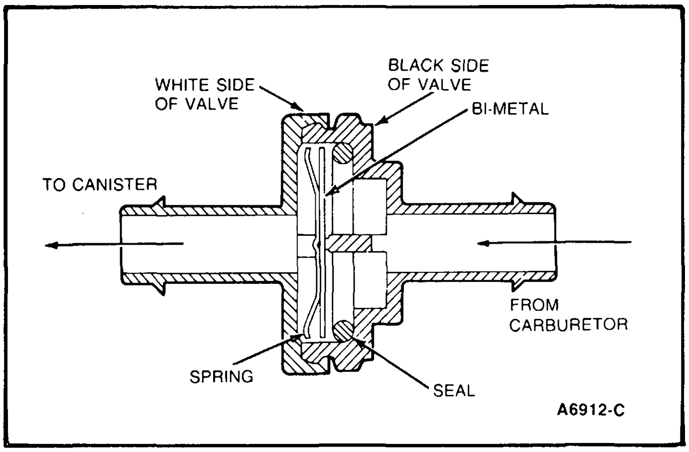
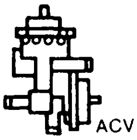


Figure 1 Fuel Bowl Thermal Vent Valve

DIAGNOSIS

At 90°F and below, the vent valve is fully closed and at 120°F and above, the vent valve is fully open. At temperatures between 90F and 120°F, the valve may be either open or closed.

The Evaporative Emission System is discussed in Section 7.

TITLE	BASIC PART NO.	SYMBOL
Combination Air Bypass/Air Control Valve	**9F491**	

DESCRIPTION

The Combination Air Bypass/Air Control Valve (9F491) combines the functions of the air bypass valve (9B289) and the air control valve (9F491) into a single unit. There are two normally closed valves; the non-bleed type Figure 1 and the bleed type Figure 2 all of which look alike. One distinguishing feature will be that the bleed type will have a the percent of bleed molded into the plastic case.

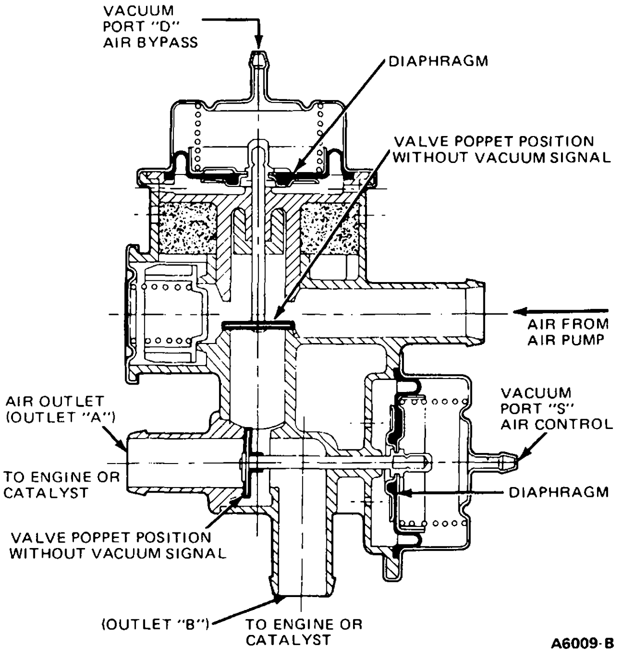
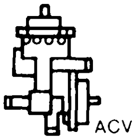

VACUUM PORT "D" AIR BYPASS
DIAPHRAGM
VALVE POPPET POSITION WITHOUT VACUUM SIGNAL
AIR FROM AIR PUMP
VACUUM PORT "S" AIR CONTROL
AIR OUTLET (OUTLET "A")
TO ENGINE OR CATALYST
DIAPHRAGM
VALVE POPPET POSITION WITHOUT VACUUM SIGNAL
(OUTLET "B")
TO ENGINE OR CATALYST
A6009-B

Figure 1 Valve Assembly—Exhaust Air Supply Control (Normally Closed) w/o Bleed

Functional Check

Normally Closed, Figures 1 and 2.

1. Disconnect hoses from outlets A and B.
2. Disconnect and plug vacuum line to port D.
3. With engine operating at 1500 rpm, airflow should be noted coming out of the bypass vents.
4. Reconnect vacuum line to port D, and disconnect and plug vacuum line to port S. Ensure vacuum is present in the line to vacuum port D.
5. With engine operating at 1500 rpm airflow should be noted coming out of outlet B (no airflow should be detected at outlet A).

TITLE	BASIC PART NO.	SYMBOL
Combination Air Bypass/Air Control Valve	**9F491**	

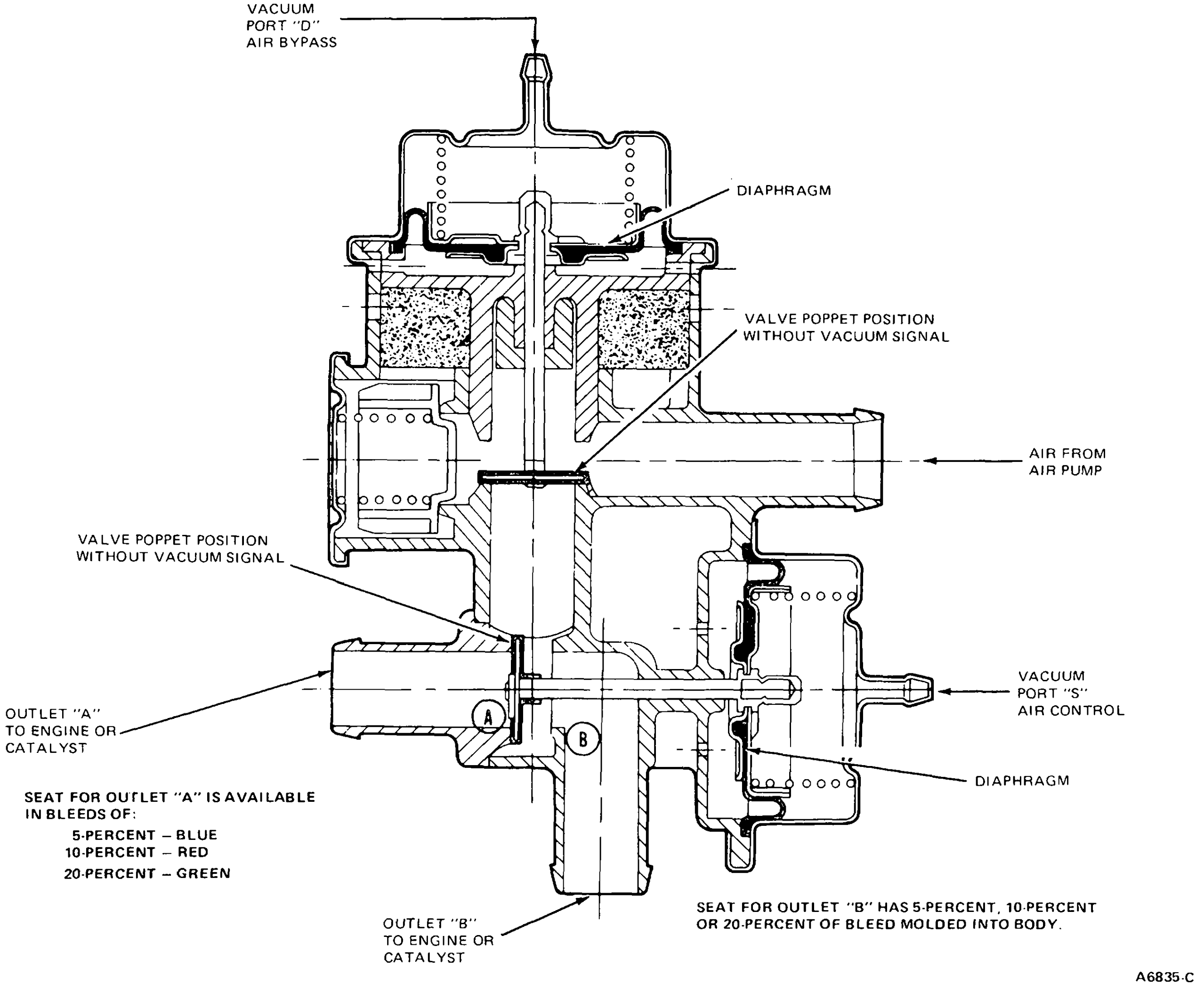

VACUUM PORT "D" AIR BYPASS
DIAPHRAGM
VALVE POPPET POSITION WITHOUT VACUUM SIGNAL
AIR FROM AIR PUMP
VALVE POPPET POSITION WITHOUT VACUUM SIGNAL
VACUUM PORT "S" AIR CONTROL
OUTLET "A" TO ENGINE OR CATALYST
A
B
DIAPHRAGM
SEAT FOR OUTLET "A" IS AVAILABLE IN BLEEDS OF:
5-PERCENT – BLUE
10-PERCENT – RED
20-PERCENT – GREEN
SEAT FOR OUTLET "B" HAS 5-PERCENT, 10-PERCENT OR 20-PERCENT OF BLEED MOLDED INTO BODY.
OUTLET "B" TO ENGINE OR CATALYST
A6835-C

Figure 2 Valve Assembly Exhaust Air Supply Control (Normally Closed) With Bleed

6. Apply 27-34 kPa (8-10 in.-Hg.) vacuum to port S. With engine operating at 1500 rpm, airflow should be noted coming out of outlet A.
7. If the valve is the bleed type, some lesser amount of air will flow from outlet A or B, and the main discharge will change when vacuum is applied to port S.

NOTE: If there is a small air tap attached to the inlet tube from the air pump, airflow should be present during engine operation.

TITLE	BASIC PART NO.	SYMBOL
DC Motor-Idle Speed Control Actuator	**9N825**	

DESCRIPTION

The DC-Motor Idle Speed Control Actuator (DC-ISCA), Figure 1, is mounted to the fuel charging assembly and controls the idle speed including such functions as: high cam rpm, anti-diesel shut-off, dashpot and pre-positioning for next vehicle start. The DC-ISCA is driven by the EEC-IV system and includes an integral Idle Tracking Switch (ITS).

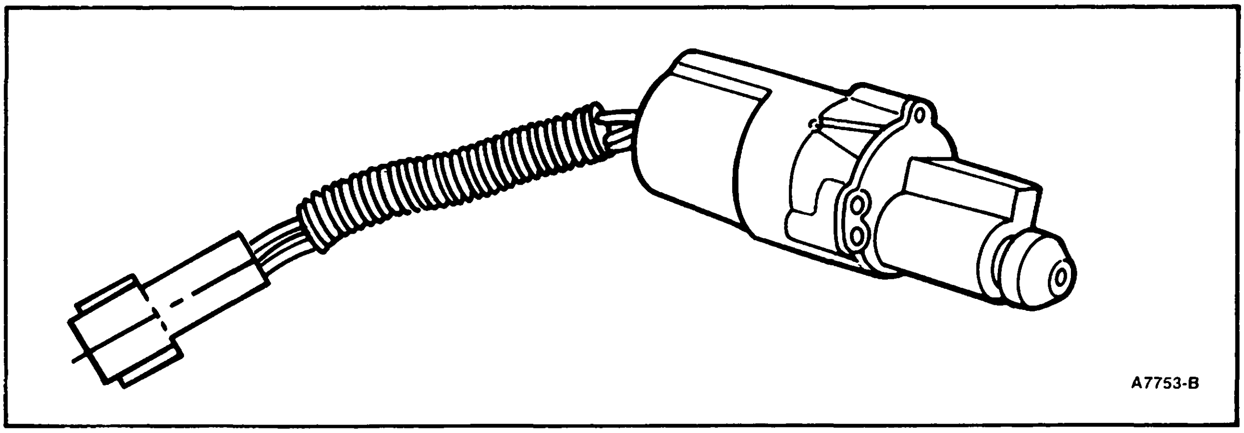


Figure 1 DC Motor-Idle Speed Control Actuator

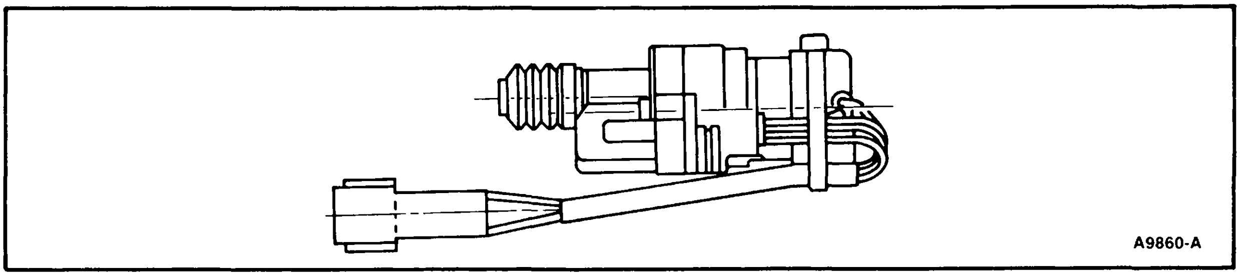


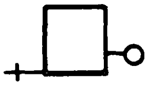
Figure 2 DC Motor-Idle Speed Control Actuator 2.0L Ranger Only

DIAGNOSIS

Refer to the EEC-IV Quick Test, Section 16.

APPLICATIONS

PART NUMBER	ENGINE	VEHICLE
E7DF-9N825-AA	1.9L CFI	Passenger Car
E7DF-9N825-AA	2.5L HSC	Passenger Car
E73F-9N825-AA	2.3L HSC CFI	Passenger Car
E75F-9N825-AA	3.8L CFI	Passenger Car
E77F-9N825-AA	2.0L	Light Truck

TITLE	BASIC PART NO.	SYMBOL
Distributor Modulator Valve Assembly—One Port	**12A170**	 SOL V

DESCRIPTION

The one-port normally open valve assembly is designed with an atmospheric vent.

The one vacuum port is connected to the atmospheric vent when the solenoid is de-energized. When the solenoid is energized, the atmospheric vent is closed.

This valve assembly is used in the choke pulldown system.

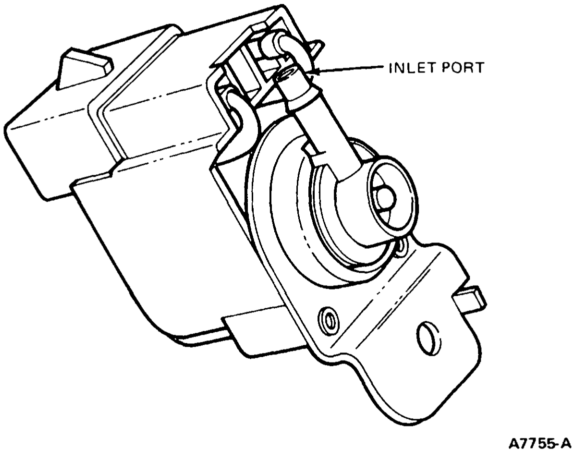
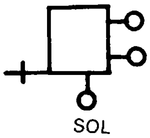


Figure 1 Distributor Modulator Valve Assembly—One-Port

DIAGNOSIS

The valve should allow airflow when the solenoid is de-energized. When the solenoid is energized, airflow is blocked. The solenoid resistance when measured at the terminals should be between 51 and 108 ohms. If the solenoid resistance is not within these values, replace the solenoid.

NOTE: The valve can be expected to have a very small leakage when energized. This leakage is not measurable in the field and is not detrimental to valve function.

TITLE	BASIC PART NO.	SYMBOL
Distributor Modulator Valve Assembly—3 Port	**12A170**	

DESCRIPTION

The three-port, solenoid valve assembly (Figure 1), consists of three vacuum ports. Port A which is common, is opened to port B and closed to port C when the solenoid is de-energized. When energized, port A is opened to port C and closed to port B.

The three-port solenoid valve assembly is used in the Throttle Kicker System.

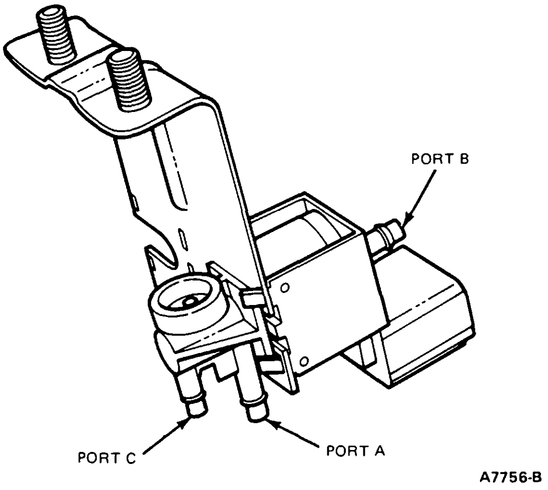


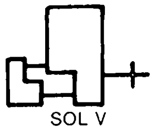
Figure 1 Three-Port Distributor Modulator Valve Assembly

DIAGNOSIS

The valve should allow airflow between ports A and B when the solenoid is de-energized, and between ports A and C when the solenoid is energized.

The solenoid resistance should be between 51 and 108 ohms. If the solenoid resistance is not within these values, replace the solenoid.

NOTE: The valve can be expected to have a very small leakage rate when energized or de-energized, this leakage is not measurable in the field and is not detrimental to valve function.

TITLE	BASIC PART NO.	SYMBOL
Dual Thermactor Air Control Solenoid Valve	**9D474**	

DESCRIPTION

The dual thermactor air control solenoid valve assembly consists of two normally closed solenoid vacuum valves (TAB & TAD), one controlling the thermactor air bypass valve and the other the thermactor diverter valve. Both are vented when de-energized, sourced by the intake manifold vacuum reservoir and controlled by an EEC system (they are also discussed in the EEC and MCU Systems diagnostic procedures).

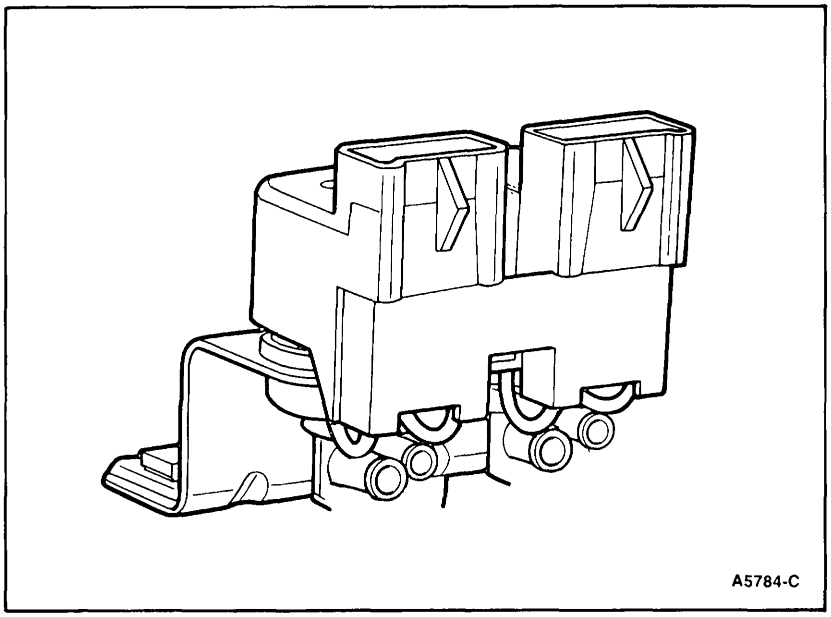


Figure 1 Dual Thermactor Air Control Solenoid Valve

DIAGNOSIS

For diagnostics, refer to the EEC-IV Quick Test, Section 16.

The function of each valve can be determined by externally energizing with vacuum sourced and output gauged. (Refer to solenoid vacuum valve, NC).

The resistance of each solenoid should be between 51 and 108 ohms when checked at the coil terminals. If the resistance is not within these values, the solenoid should be replaced.

NOTE: The valves can be expected to have a very small leakage rate when energized or de-energized. This leakage is not measurable in the field and is not detrimental to valve function.

TITLE	BASIC PART NO.	SYMBOL
EGR Backpressure Variable Transducer	**9J431**	

DESCRIPTION

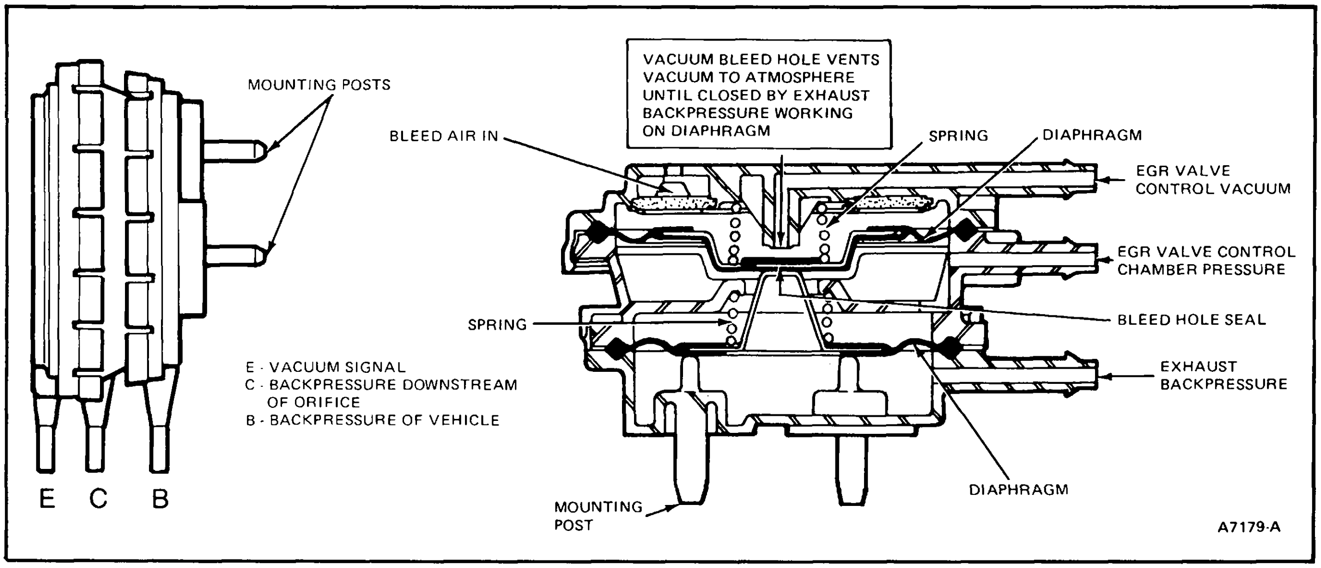
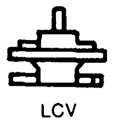

MOUNTING POSTS
BLEED AIR IN
VACUUM BLEED HOLE VENTS VACUUM TO ATMOSPHERE UNTIL CLOSED BY EXHAUST BACKPRESSURE WORKING ON DIAPHRAGM
SPRING
DIAPHRAGM
EGR VALVE CONTROL VACUUM
EGR VALVE CONTROL CHAMBER PRESSURE
BLEED HOLE SEAL
SPRING
EXHAUST BACKPRESSURE
E - VACUUM SIGNAL
C - BACKPRESSURE DOWNSTREAM OF ORIFICE
B - BACKPRESSURE OF VEHICLE
E C B
MOUNTING POST
DIAPHRAGM
A7179-A

Figure 1 EGR Backpressure Variable Transducer

DIAGNOSIS

Refer to Section 6, Exhaust Gas Recirculation (EGR) System.

TITLE	BASIC PART NO.	SYMBOL
EGR Load Control (WOT) Valve	**9F424**	

DESCRIPTION

This valve dumps EGR vacuum at or near WOT.

The normal path between Ports A and B is vented to atmosphere when sufficient vacuum is applied to Port C.

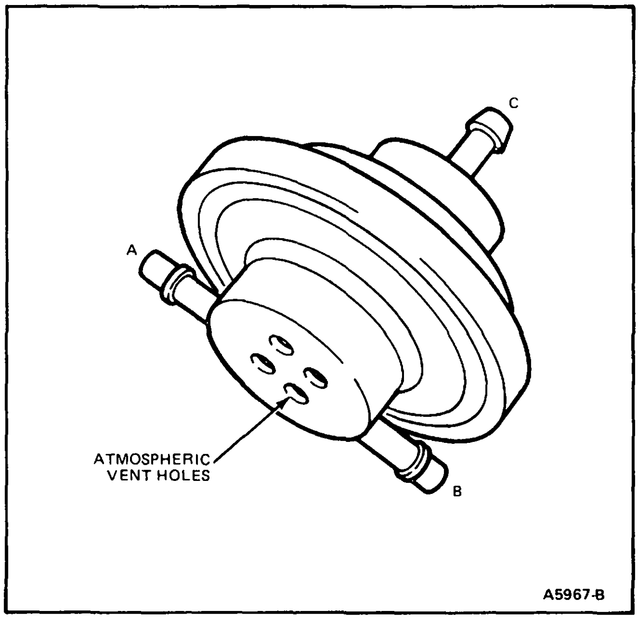


Figure 1 EGR Vacuum Load Control (WOT) Valve

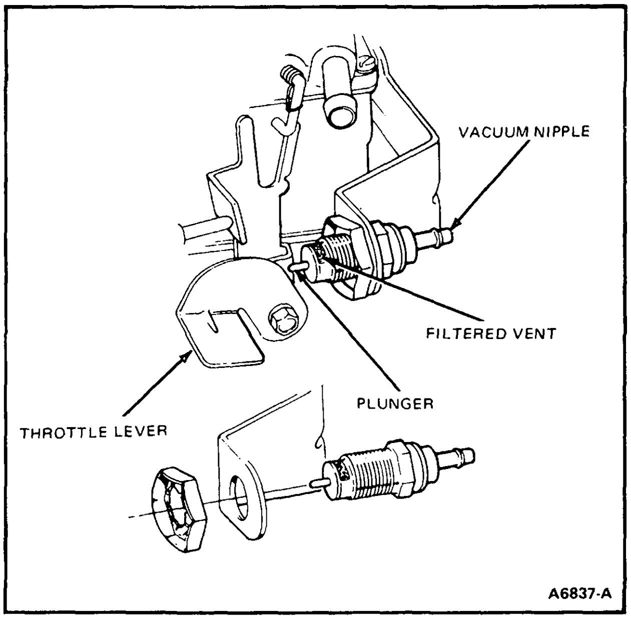


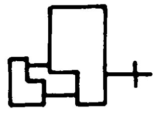
Figure 2 WOT Valve for Carter Carburetor

Functional Check

- With the engine running at normal operating temperature, set throttle on kickdown step (high cam for 2.3L).
- Connect Rotunda Vacuum Gauge 059-00008 or equivalent to the EGR side of the WOT valve, and note the reading.
- Using Rotunda Vacuum Tester 021-00014 or equivalent, apply a vacuum of at least 20.26 kPa (6 in.-Hg.) to the WOT venturi port (Port C).
- Gauge should drop to zero. If not, replace the valve.
- Remove test equipment, and restore connections.

Functional Check (Adjustment)

Adjust so that hand pump vacuum at the vacuum nipple will drop when WOT is approached without limiting throttle travel.

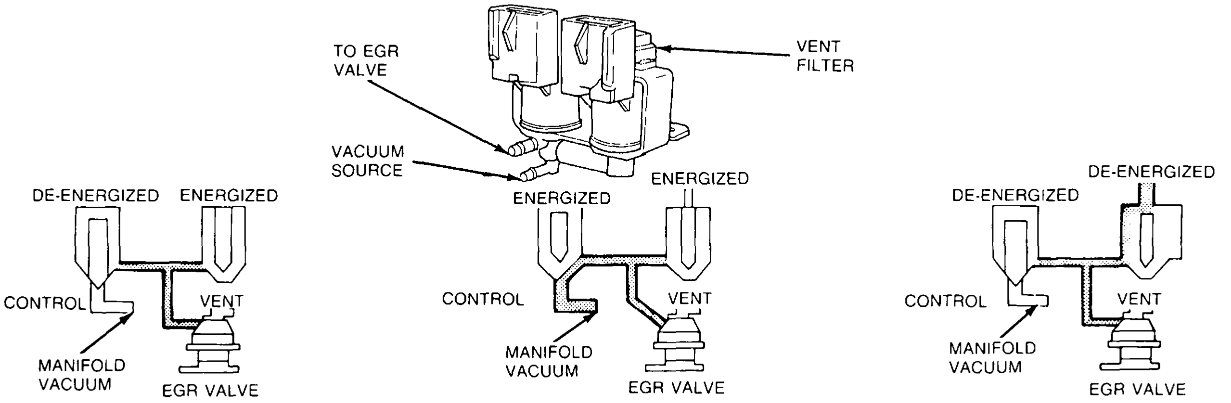
TITLE	BASIC PART NO.	SYMBOL
EGR Solenoid Vacuum Valve Assembly	**9D474**	

DESCRIPTION

Dithering Type

The dual EGR solenoid valve assembly consists of two dithering solenoid valves. One is a vacuum valve which supplies vacuum to the sonic EGR valve when energized. The second valve is a vent valve which vents the EGR valve to the atmosphere when de-energized. Both solenoid valves receive variable duty cycle signals from ECU (EEC-IV) according to EGR requirements. A restrictor is added in vacuum valve inlet port to reduce its flow compared to vent valve. So in case vacuum valve sticks open, the vent valve will be capable of venting the vacuum flow immediately without affecting the devices being controlled.

It is used with the EGR valve in EEC-IV systems.



MAINTAIN EGR FLOW	INCREASE EGR FLOW	DECREASE EGR FLOW
EXISTING VACUUM IS TRAPPED IN LINE, HOLDING EGR VALVE IN SAME POSITION	INCREASED VACUUM OPENS EGR VALVE FOR MORE EGR FLOW	EXISTING VACUUM IN LINES IS VENTED TO ATMOSPHERE

A5931-C

Figure 1 EGR Solenoid Valve Assembly—Dithering Type

DIAGNOSIS

The resistance of each solenoid should be between 32 and 64 ohms. If the solenoid is not within these values, the solenoid should be replaced.

The vent valve should flow when the solenoid is de-energized.

The control valve should flow air when solenoid is energized.

Refer to the EEC-IV Quick Test, Section 16.

NOTE: The valves can be expected to have a very small leakage rate when energized or de-energized. This leakage is not measurable in the field and is not detrimental to valve function.

TITLE	BASIC PART NO.	SYMBOL
EGR Vacuum Control Valve Filter	**9E491**	

DESCRIPTION

The EGR vacuum control valve filter (Figure 1) is used to vent various emission control components to atmosphere. If the filter is blocked, replace it.

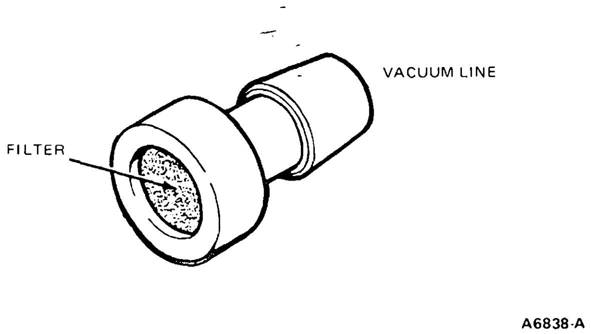


Figure 1 EGR Vacuum Control Valve Filter

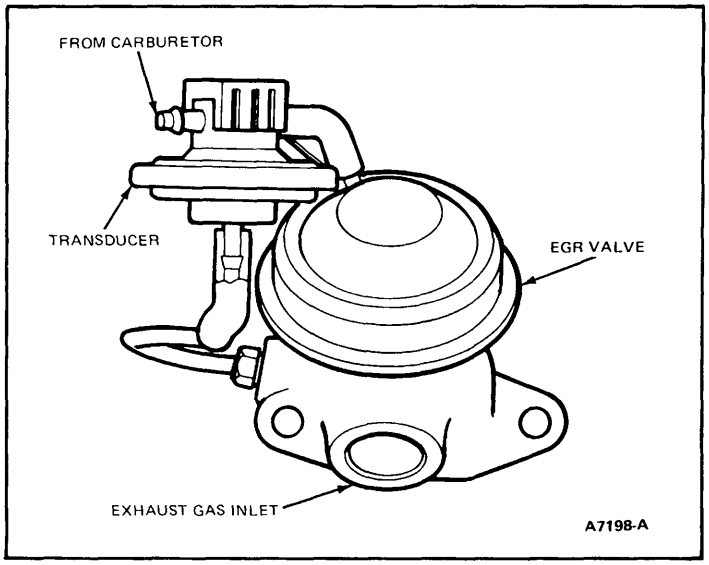
TITLE	BASIC PART NO.	SYMBOL
EGR Valve and Transducer Assembly	**9H495**	

DESCRIPTION

EGR Valve and Transducer Assembly

The Valve and Transducer Assembly (9H495) which consists of a modified ported EGR valve and a remote transducer, is used on selected 2.0/2.3L engines, (Figure 1). This assembly operates the same as the Integral Backpressure Transducer EGR Valve (9D448) and is diagnosed and serviced as an assembly only. Valve function checks are the same as those for the Integral Backpressure Transducer EGR Valve.

When servicing the assembly or any related vacuum harness, it is important to ensure proper orientation of the transducer. The nipple of the transducer attached to the metal tube from the EGR valve base must point straight down after installation. This allows drainage of exhaust gas condensation that may accumulate.



DIAGNOSIS

Refer to Section 6, Exhaust Gas Recirculation (EGR) System.

TITLE	BASIC PART NO.	SYMBOL
EGR Valve-Electronic	**9F483**	

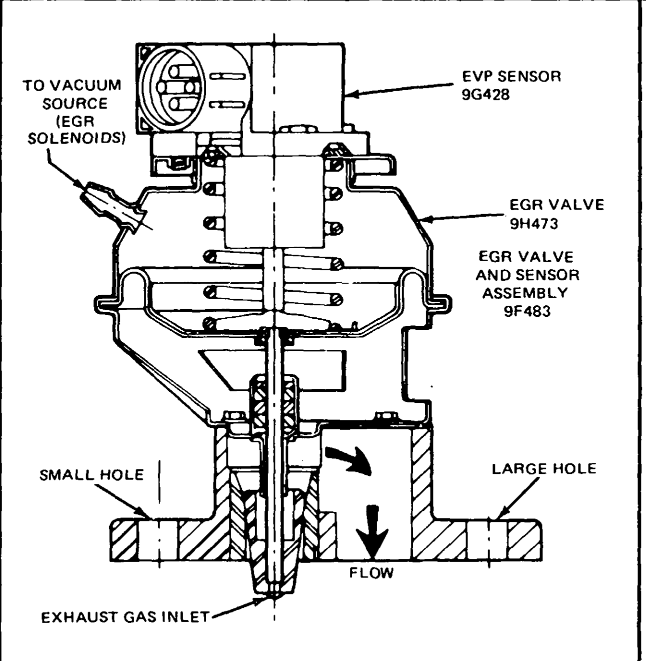
DESCRIPTION

The Electronic EGR Valve, Figure 1, is required in EEC systems where EGR flow is controlled according to computer demands by means of an EGR valve position (EVP) sensor attached to the valve.

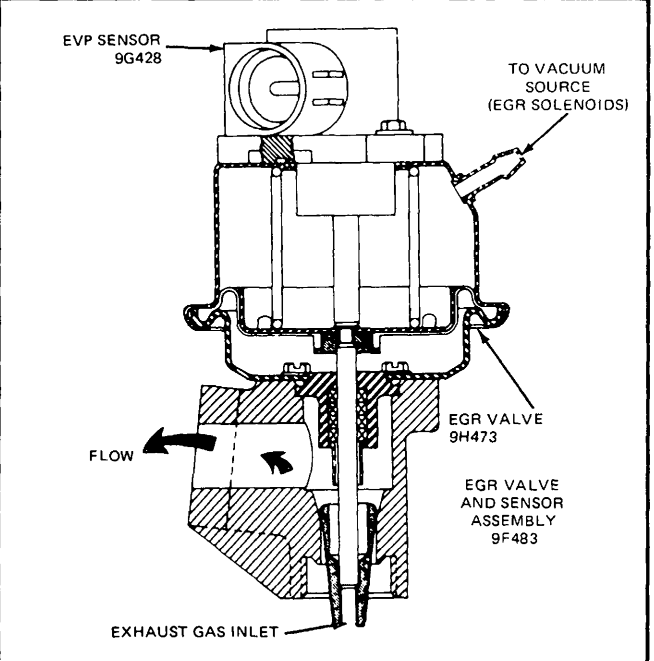
The valve is operated by a vacuum signal from the dual EGR Solenoid Valves (9D474) or the electronic vacuum regulator (9J459) which actuates the valve diaphragm.

As supply vacuum overcomes the spring load the diaphragm is actuated which lifts the pintle off its seat allowing exhaust gas to recirculate (flow). The amount of flow is proportional to the pintle position. The EVP sensor mounted on the valve sends an electrical signal of its position to the Electronic Control Assembly (12A650).

The Electronic EGR Valve Assembly (9F483) is not serviceable. The EVP sensor (9G428) and EGR valve (9H473) must be serviced separately.



BASE ENTRY TYPE A7192-B


EVP SENSOR 9G428
TO VACUUM SOURCE (EGR SOLENOIDS)
FLOW
EGR VALVE 9H473
EGR VALVE AND SENSOR ASSEMBLY 9F483
EXHAUST GAS INLET

SIDE (EXTERNAL) ENTRY TYPE A7191-B

DIAGNOSIS

Verify vacuum routing per the vehicle decal before proceeding to EEC-IV Quick Test, Section 16.

TITLE	BASIC PART NO.	SYMBOL
EGR Valve-Integral Backpressure Transducer	**9D448**	

DESCRIPTION

The integral backpressure transducer EGR valve combines inputs of backpressure and EGR port vacuum into one unit. The valve requires BOTH inputs to operate. The valve will not operate on vacuum alone. The backpressure valve has two types; poppet and tapered pintle, Figure 1.

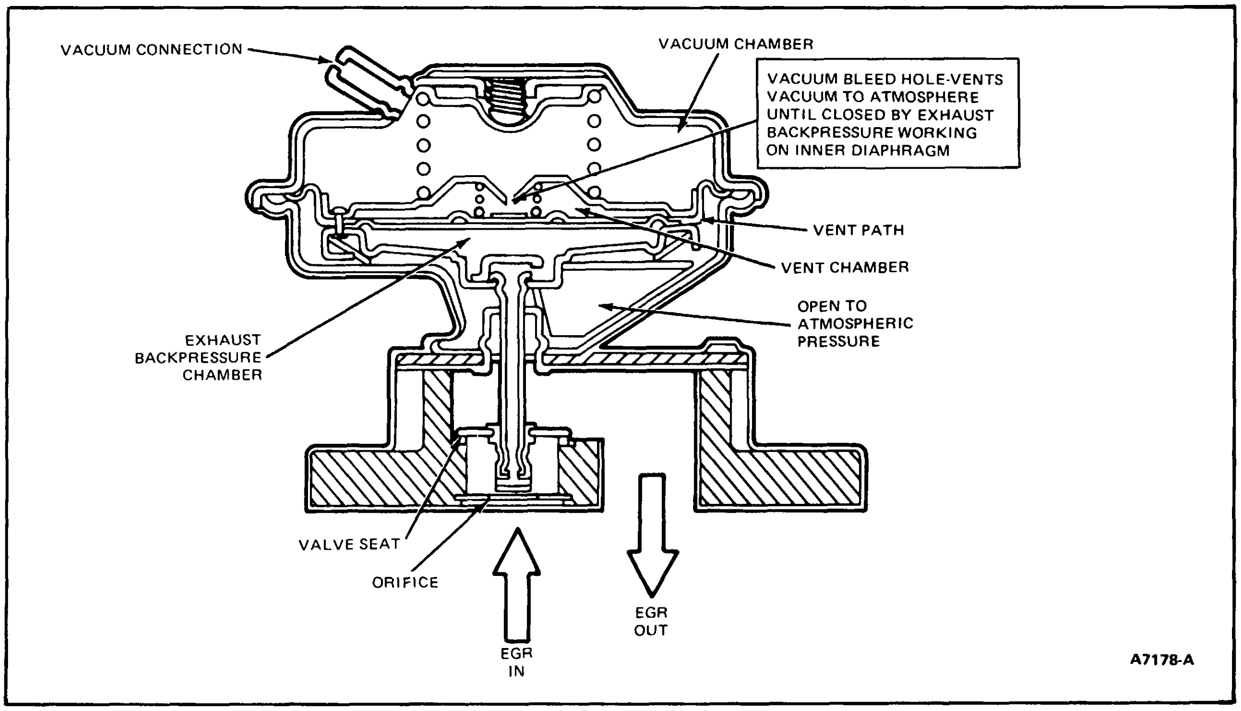

VACUUM CONNECTION
VACUUM CHAMBER
VACUUM BLEED HOLE-VENTS VACUUM TO ATMOSPHERE UNTIL CLOSED BY EXHAUST BACKPRESSURE WORKING ON INNER DIAPHRAGM
VENT PATH
VENT CHAMBER
OPEN TO ATMOSPHERIC PRESSURE
EXHAUST BACKPRESSURE CHAMBER
VALVE SEAT
ORIFICE
EGR IN
EGR OUT
A7178-A

Figure 1 Integral Backpressure Transducer EGR Valve (9D448)

DIAGNOSIS

Refer to Section 6, Exhaust Gas Recirculation (EGR) System.

TITLE	BASIC PART NO.	SYMBOL
EGR Valve-Ported	**9D475**	

DESCRIPTION

The ported EGR Valve is operated by a vacuum signal (only) from the carburetor EGR port signal which actuates the valve diaphragm. As the vacuum increases sufficiently to overcome the power spring, the valve is opened allowing EGR flow. The amount of flow is dependent on the tapered pintle or the poppet position which is a direct result of vacuum signal, Figure 1.

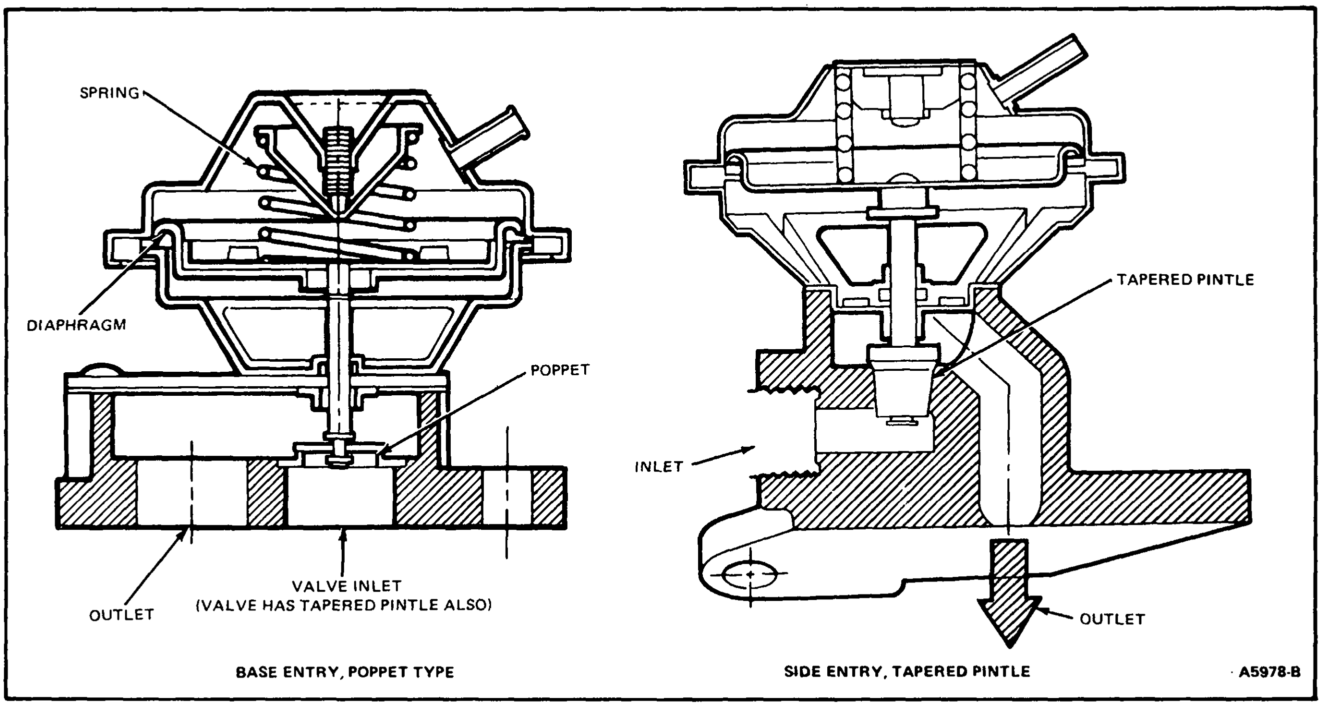


Figure 1 Ported EGR Valve (9D475)

DIAGNOSIS

Refer to Section 6, Exhaust Gas Recirculation (EGR) System.

TITLE	BASIC PART NO.	SYMBOL
EGR Valve Position Sensor	**9G428**	

DESCRIPTION

The EVP Sensor provides EEC System with a signal indicating position of the EGR valve.

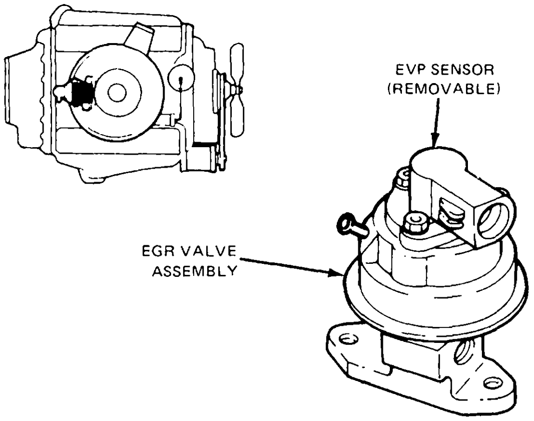
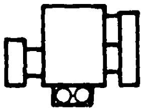


Figure 1 EGR Valve Position (EVP) Sensor

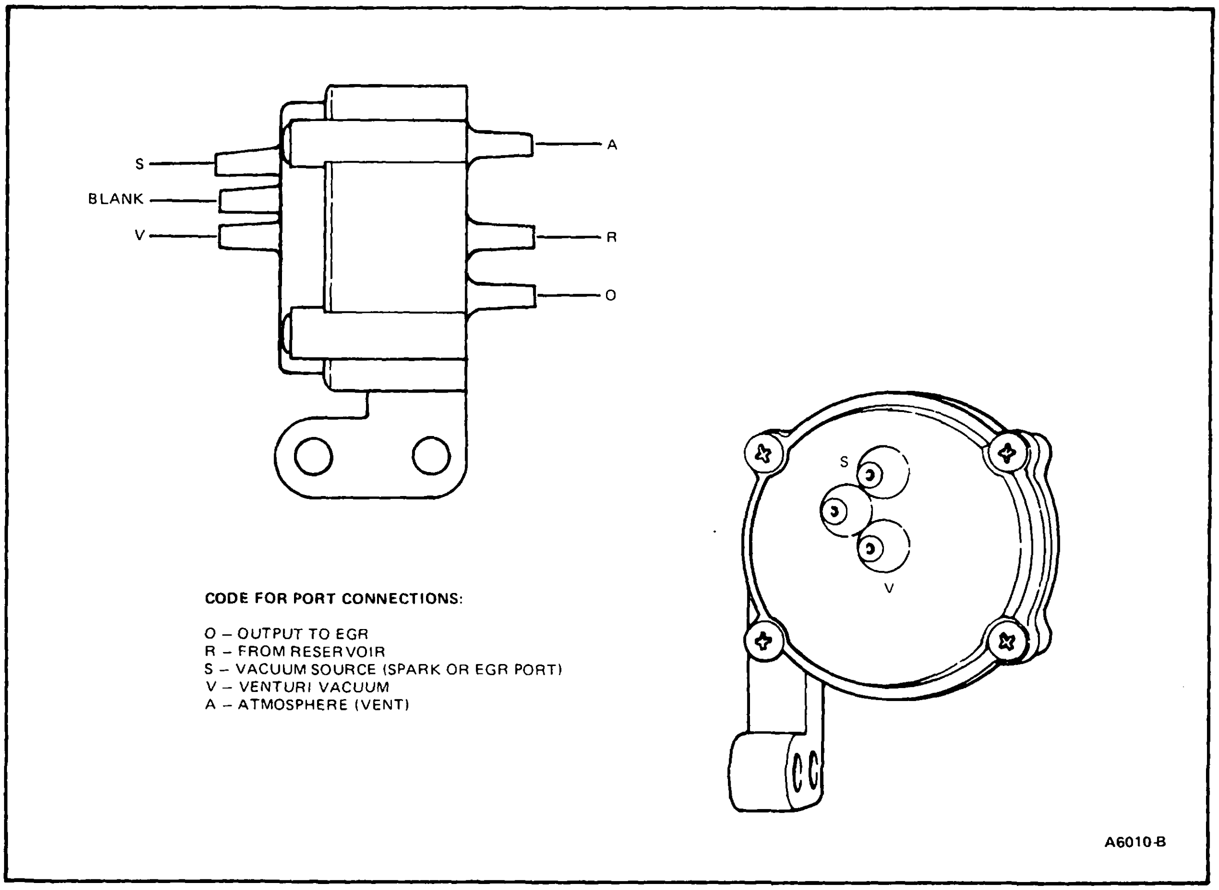
DIAGNOSIS

Refer to the EEC-IV Quick Test, Section 16.

TITLE	BASIC PART NO.	SYMBOL
EGR Venturi Vacuum Amplifier	**9E451**	 VVA

DESCRIPTION

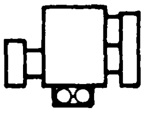
The EGR Venturi Vacuum Amplifier (Figures 1 and 2) uses a relatively weak venturi vacuum to control a manifold vacuum signal to operate the EGR valve. It contains a check valve and a relief valve that opens whenever the venturi vacuum signal is equal to or greater than manifold vacuum.



CODE FOR PORT CONNECTIONS:

O – OUTPUT TO EGR
R – FROM RESERVOIR
S – VACUUM SOURCE (SPARK OR EGR PORT)
V – VENTURI VACUUM
A – ATMOSPHERE (VENT)

Figure 1 EGR Venturi Vacuum Amplifier

TITLE	BASIC PART NO.	SYMBOL
EGR Venturi Vacuum Amplifier	**9E451**	

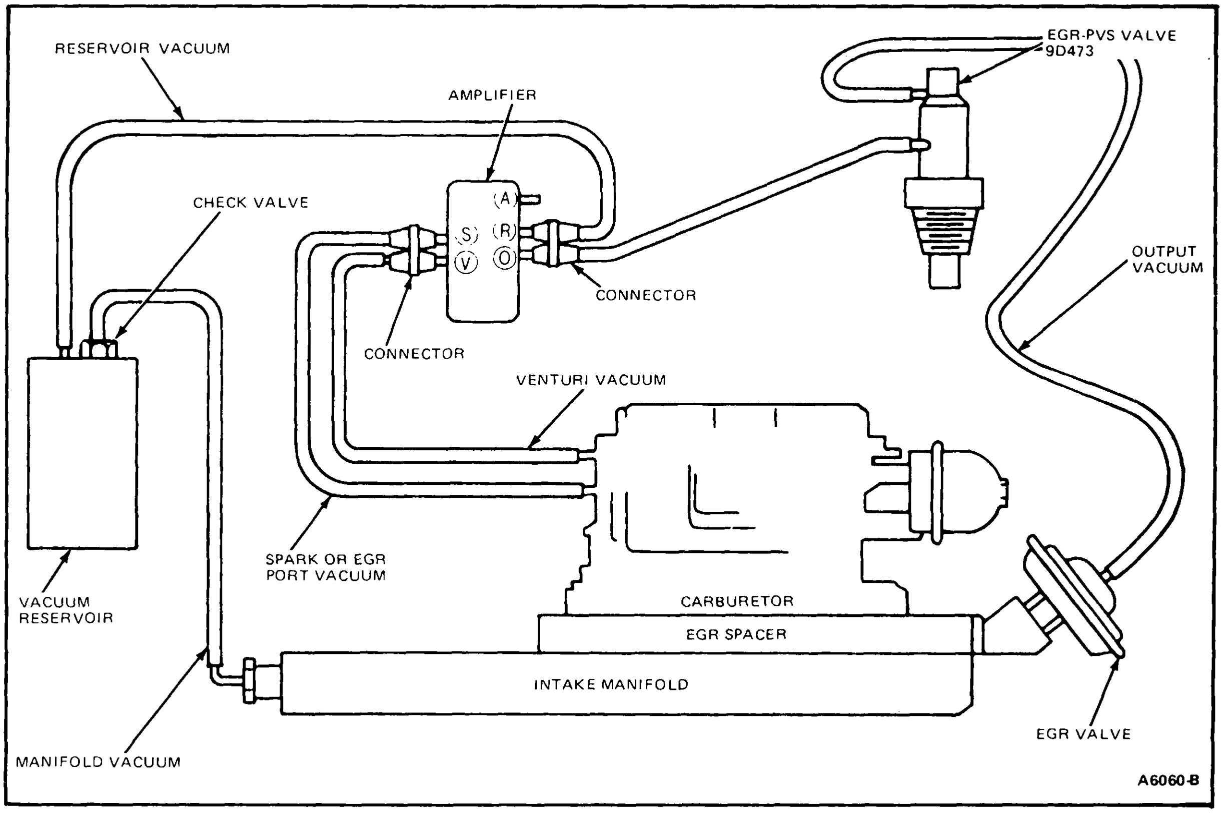


Figure 2 Typical EGR System with Venturi Vacuum Amplifier

Functional Check

Conditions

- Normally warm engine.
- Proper Curb Idle.
- Adequate Manifold Vacuum.

Test

- Connect Rotunda Vacuum Gauge 059-00008 or equivalent to the hose at the EGR Port O. The gauge may read as much as 6.8 kPa (2 in.-Hg.) at idle.
- Disconnect the venturi hose at the carburetor, and increase engine speed to 2000 rpm. Vacuum should not change.
- Maintain high engine speed, and connect venturi hose. Gauge should register at least 13.5 kPa (4 in.-Hg.).
- Return to idle. Gauge should return to initial reading.
- If the above conditions are not met, replace the VVA.

TITLE	BASIC PART NO.	SYMBOL
Electronic Control Assembly (EFI/CFI/FBC)	**12A650**	

DESCRIPTION

The center of the EEC-IV system is a microprocessor called the Electronic Control Assembly (ECA). The ECA, (Figure 1), receives data from a number of sensors and other electronic components (switches, relays, etc.). The ECA contains a specific calibration for optimizing emissions, fuel economy, and driveability. Based on information received and programmed into its memory, the ECA generates output signals to control various relays, solenoids, and other actuators.

The ECA in the EEC-IV system is a microprocessor like the one in the other EEC systems. One significant difference is that this ECA has the calibration module located inside the ECA assembly, unlike the EEC-III system.

The ECA is found in different locations, depending on the model. Refer to the chart for locations.

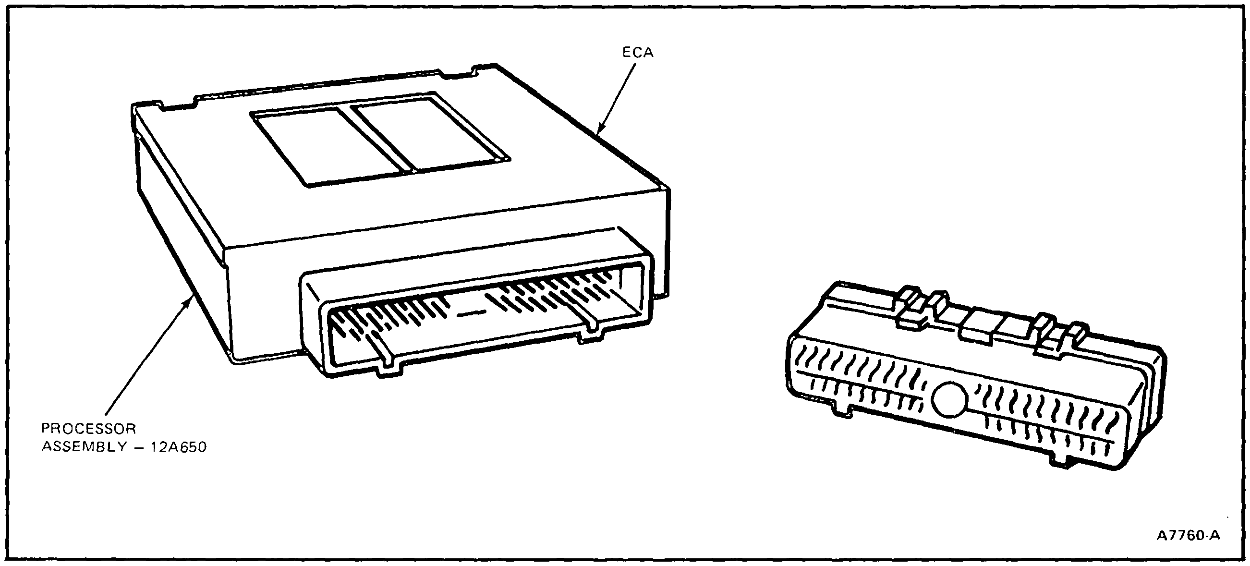


Figure 1 Electronic Control Assembly (ECA)

Vehicle	Location
Mark VII/Continental, Thunderbird/Cougar, Mustang, XR4Ti, Ranger/Bronco II	RH dash panel behind kick panel
Tempo/Topaz, Escort/Lynx/EXP	Under instrument panel left of steering column
Taurus/Sable	Ahead of glove compartment
Lincoln Town Car, Ford Crown Victoria/Mercury Grand Marquis Aerostar	LH side dash panel in passenger compartment
Econoline with A/C	Rear surface of A/C blower ·
Econoline without A/C	Under instrument panel on passenger side
F-Series/Bronco	LH dash panel behind kick panel

CA8314-C

DIAGNOSIS

Refer to the EEC-IV Quick Test, Section 16.

TITLE	BASIC PART NO.	SYMBOL
Electronic Vacuum Regulator	**9J459**	

DESCRIPTION

The Electronic Vacuum Regulator (EVR) is an electromagnetic device which controls vacuum output to the EGR valve. The EVR replaces the EGR Solenoid Vacuum Vent Valve Assembly (9D474). An electric current in the coil induces a magnetic field in the armature. The magnetic field pushes against a spring loaded disc increasing the vacuum level. The vacuum source is either manifold or port vacuum. As the current is increased an increased vacuum signal goes to the EGR.

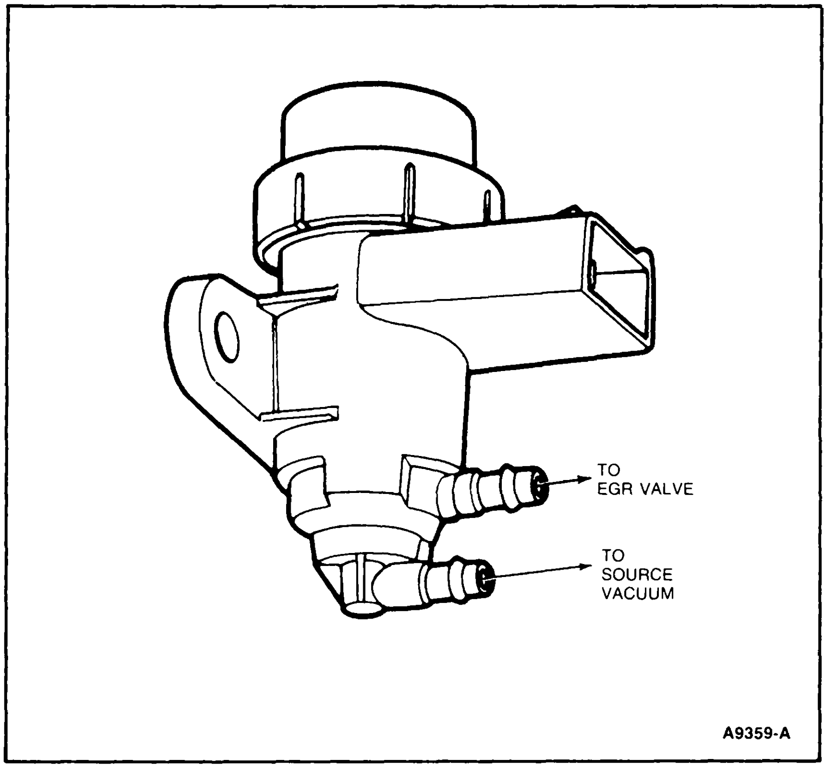


Figure 1 Electronic Vacuum Regulator

DIAGNOSIS

Refer to the EEC-IV Quick Test, Section 16.

TITLE	BASIC PART NO.	SYMBOL
Engine Coolant Temperature Sensor	**12A648**	

DESCRIPTION

The Engine Coolant Temperature (ECT) Sensor, Figure 1 detects the temperature of engine coolant and supplies the information to Electronic Control Assembly (ECA).

The ECT sensor is threaded into the heater outlet fitting or cooling passage on the engine. For engine control applications, the ECT signal is used to modify ignition timing, EGR flow, and air to fuel ratio as a function of engine coolant temperature. On electronic instrument cluster applications, the ECT output is used to control a coolant temperature indicator.

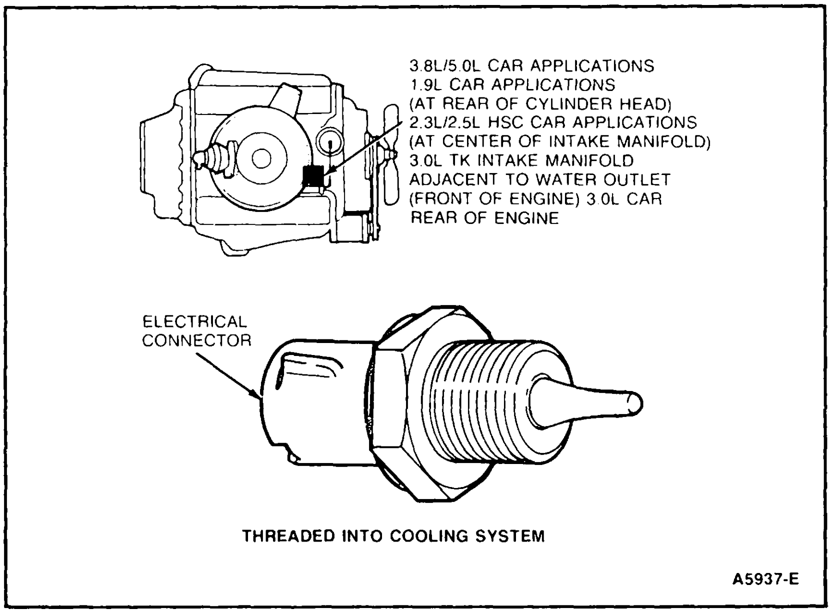

3.8L/5.0L CAR APPLICATIONS
1.9L CAR APPLICATIONS
(AT REAR OF CYLINDER HEAD)
2.3L/2.5L HSC CAR APPLICATIONS
(AT CENTER OF INTAKE MANIFOLD)
3.0L TK INTAKE MANIFOLD
ADJACENT TO WATER OUTLET
(FRONT OF ENGINE) 3.0L CAR
REAR OF ENGINE
ELECTRICAL CONNECTOR
THREADED INTO COOLING SYSTEM
A5937-E

Figure 1 Engine Coolant Temperature (ECT) Sensor

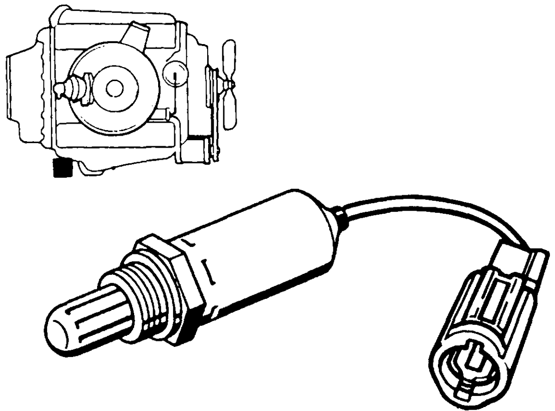
DIAGNOSIS

Refer to the EEC-IV Quick Test, Section 16.

TITLE	BASIC PART NO.	SYMBOL
Exhaust Gas Oxygen Sensor	**9F472**	

DESCRIPTION

The EGO Sensor supplies ECA with a signal which indicates either a rich or lean condition during engine operation.


THREADED INTO REAR OF LEFT AND RIGHT EXHAUST MANIFOLD ON V6 3.8L ENGINE

THREADED INTO REAR OF RIGHT EXHAUST MANIFOLD ON V8 5.8L ENGINE

Figure 1 Exhaust Gas Oxygen (EGO) Sensor

DIAGNOSIS

Refer to the EEC-IV Quick Test, Section 16.

TITLE	BASIC PART NO.	SYMBOL
Exhaust Heat Control Valve	**9A427**	

DESCRIPTION

The purpose of the exhaust heat control valve, (Figure 1) is to divert hot gases from the exhaust manifold to the intake manifold riser pad. Heat is transferred from the exhaust gas to the riser pad, which in turn heats the incoming fuel/air charge. There are two types currently available; the bimetal spring type and the vacuum actuated type.

Bimetal Type

Refer to Section 5 for a complete description.

Vacuum Operated

The vacuum operated heat valve functions as follows:

- When the engine is started, the valve is closed by intake manifold vacuum acting on the vacuum motor.
- The valve will stay closed until one of two conditions occurs:
  1. When the engine coolant temperature reaches a predetermined value, the vacuum supply to the heat valve is shut-off by a temperature sensing vacuum switch and the heat valve opens.
  2. When the engine speed/load condition causes a drop in intake manifold vacuum below a specific value, the heat valve opens.

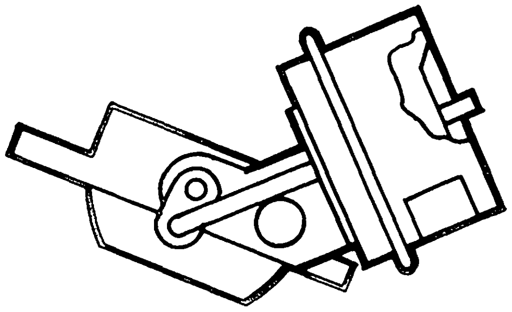


Figure 1 Exhaust Heat Control Valve

Functional Check

Apply 33.77-67.54 kPa (10-15 in.-Hg.) vacuum to the vacuum motor using a hand vacuum pump, Rotunda 021-00014 or equivalent, and trap for 60 seconds. The valve must close and not leak more than 6.75 kPa (2 in.-Hg.) and open when the vacuum is released. If it does not operate in this manner replace the valve.

TITLE	BASIC PART NO.	SYMBOL
Feedback Carburetor Actuator Motor	**9C908**	

DESCRIPTION

The Actuator (Figure 1) is part of the Carburetor Feedback Control System, used on 7200 model carburetors. The actuator is threaded into the carburetor body, and its actuator shaft moves a fuel metering pintle valve to produce a richer or leaner air/fuel mixture at the carburetor. In response to an electronic signal coming from the Exhaust Gas Oxygen (EGO) sensor and conditioned by the EEC (or MCU) System, the actuator shaft moves in and out.

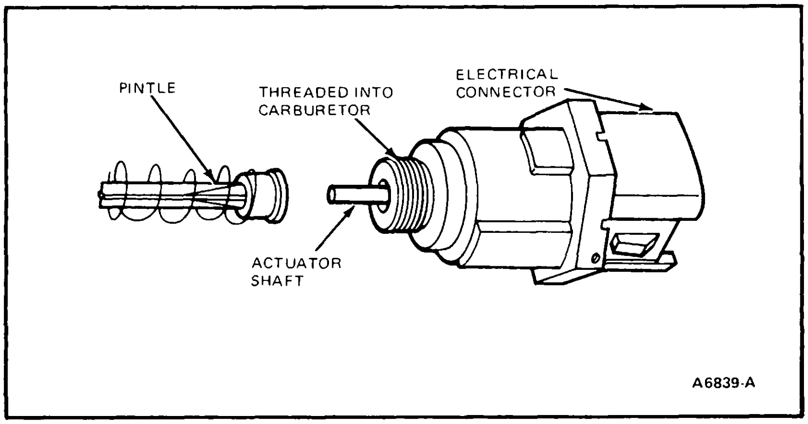
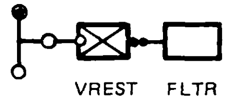


Figure 1 Feedback Carburetor Actuator Motor

DIAGNOSIS

1. Remove the FBCA motor from carburetor. Connect wiring harness to FBCA motor; turn ignition switch to Run to extend shaft. Turn ignition switch to Off. If FBCA shaft does not extend, replace FBCA motor and retest.
2. Push FBCA motor shaft back in by hand. If shaft will not push in, replace FBCA motor and retest.
3. Remove and clean pintle valve, spring and carburetor passage with choke cleaner and a small brush.
4. Reinstall pintle, spring and FBCA motor. Tighten FBCA motor to 8-10 lb-ft.
5. Retest per appropriate quick test.
6. Check/reset curb idle, if necessary.

NOTE: FBCA motor is partly diagnosed as a part of the 5.8L MCU electronic system. Refer to the 5.8L FBC Police and Canadian Trailer Tow MCU Diagnosis Manual.

TITLE	BASIC PART NO.	SYMBOL
Filter Assembly—Vacuum Vent	**9F474**	

DESCRIPTION

The Vacuum Vent Filter, (Figure 1) is used to filter air being drawn into the vacuum system when a vacuum bleed is required. It is a nylon tee with a restrictor and an open cell foam on one leg.

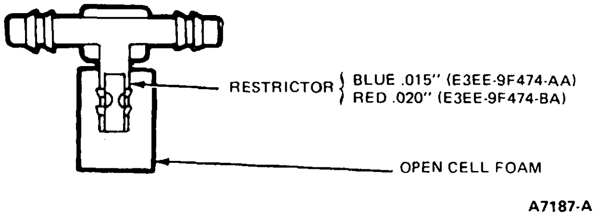


Figure 1 Vacuum Vent Filter Assembly

DIAGNOSIS

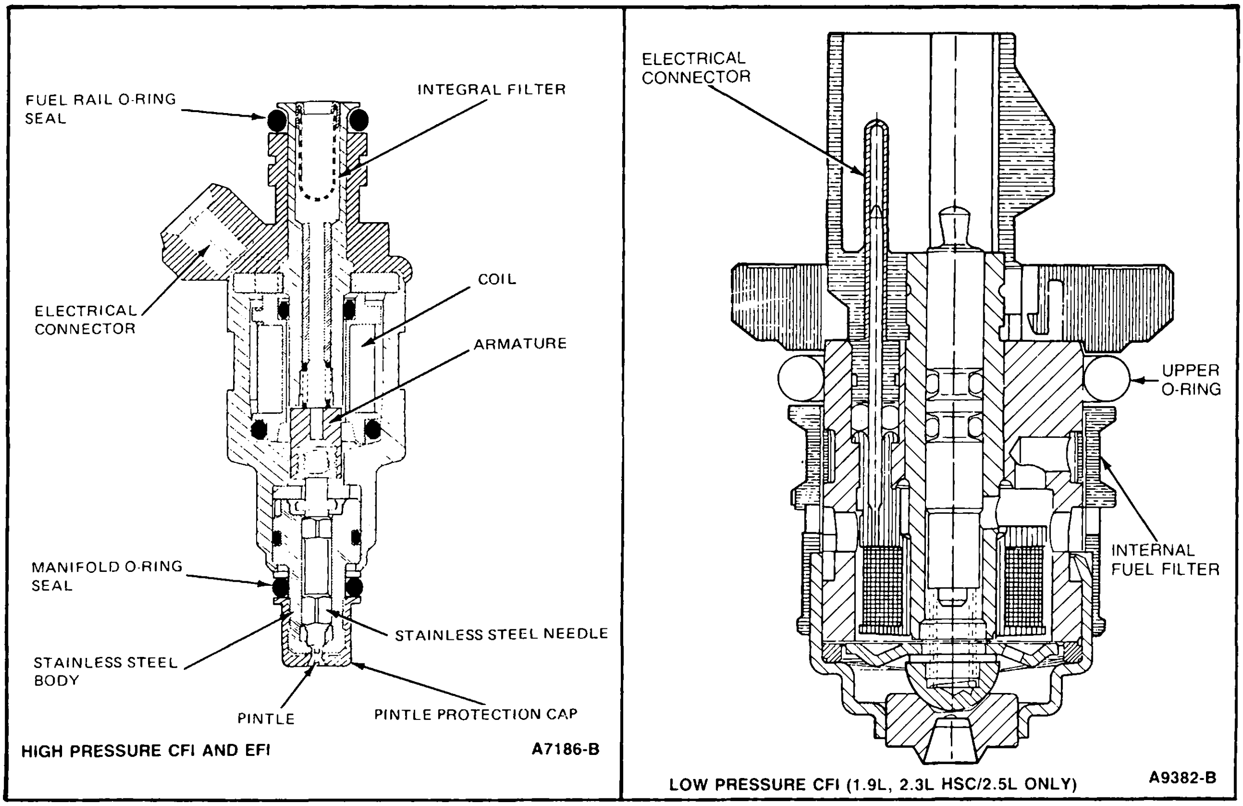
If the filter appears to be dirty, wash it in an appropriate solvent.

TITLE	BASIC PART NO.	SYMBOL
Fuel Injector	**9F593**	

DESCRIPTION

The Fuel Injector, (Figure 1) is a solenoid operated valve that meters fuel flow to the engine. The injector is opened and closed a constant number of times per crank revolution. The amount of fuel is controlled by the length of time it is held open.

The injector is normally closed and is operated by a signal from the Electronic Engine Control (EEC) module.



HIGH PRESSURE CFI AND EFI

LOW PRESSURE CFI (1.9L, 2.3L HSC/2.5L ONLY)

Figure 1 Fuel Injectors

DIAGNOSIS

NOTE: Low pressure injectors have low coil resistance. High pressure injectors can have either high or low coil resistance. Function can be adversely affected by using the wrong injectors.

NOTE: Do not apply battery voltage directly to the injector electrical connector terminals. The solenoid may be damaged internally in a matter of seconds.

Refer to the EEC-IV Quick Test, Section 16.

TITLE	BASIC PART NO.	SYMBOL
Fuel Pressure Regulator	**9C968**	

DESCRIPTION

The EFI Fuel Pressure Regulator, (Figure 1), is attached to the fuel supply manifold assembly upstream of the fuel injectors. It regulates fuel pressure supplied to the injectors.

- The regulator is a diaphragm-operated relief valve in which one side of the diaphragm is exposed to fuel pressure and the other side is subjected to intake manifold pressure for multipoint fuel injection (EFI) and atmospheric pressure for single point injection (CFI).
- The nominal fuel pressure is controlled by a spring preload applied to the diaphragm. By exposing the top side of the diaphragm to manifold pressure, a constant pressure drop is maintained across the injectors, for all modes of operation.
- Fuel in excess of that used by the engine is bypassed through the regulator and back to the fuel tank.

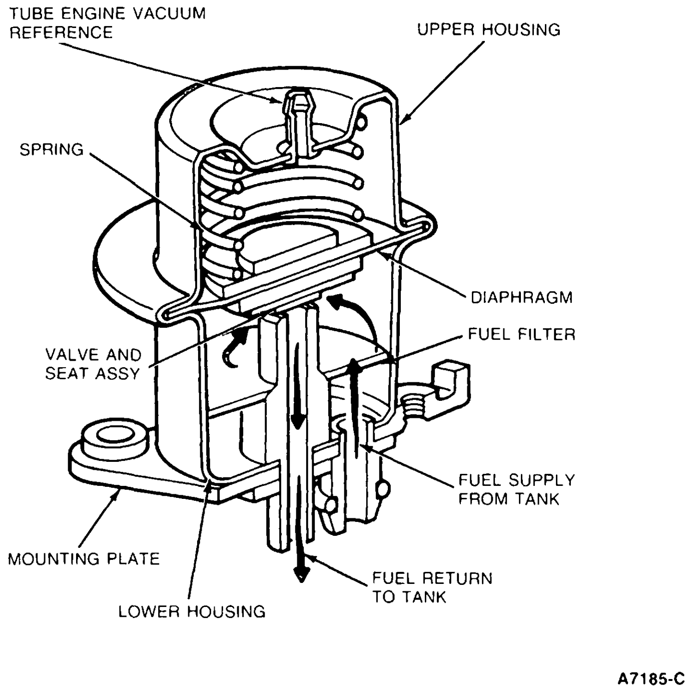


Figure 1 Fuel Pressure Regulator

TITLE	BASIC PART NO.	SYMBOL
Fuel-Vacuum Separator	**9C369**	SA-FA

DESCRIPTION

The Fuel-Vacuum Separator, Figure 1 is used in vacuum systems to prevent fuel migration to a vacuum operated device.

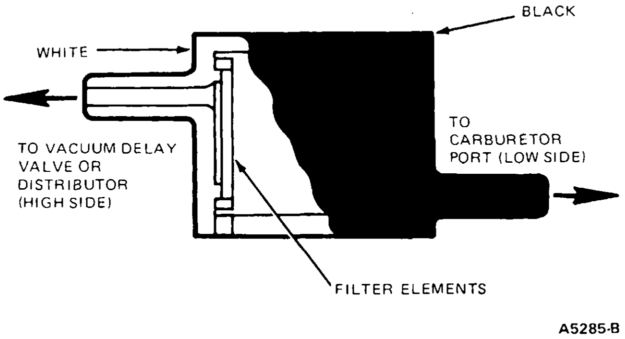

BLACK
WHITE
TO CARBURETOR PORT (LOW SIDE)
TO VACUUM DELAY VALVE OR DISTRIBUTOR (HIGH SIDE)
FILTER ELEMENTS
A5285-B

Figure 1 Fuel-Vacuum Separator

DIAGNOSIS

NOTE: Separator requires positive orientation to ensure that any fuel collected will drain back to the carburetor.

If separator becomes cracked or clogged, replace the separator.

TITLE	BASIC PART NO.	SYMBOL
Heated Exhaust Gas Oxygen Sensor	9F472	

DESCRIPTION

The Heated Exhaust Gas Oxygen Sensor (HEGO), Figure 1 supplies the ECA with a signal which indicates a rich or lean condition during engine operation.

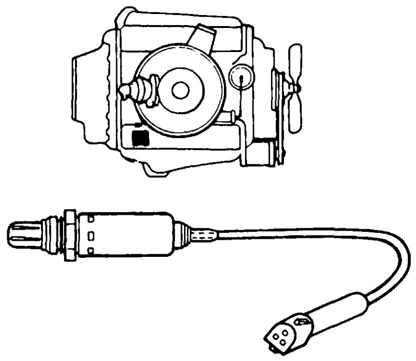

THREADED INTO EXHAUST MANIFOLD ON 2.3L
THREADED INTO CROSSOVER BOSS TUBULAR RUNNER ON 1.9L EFI
THREADED INTO EXHAUST MANIFOLD ON 1.9L 5.0L
THREADED INTO CENTER REAR OF EXHAUST MANIFOLD ON 2.3L HSC
THREADED INTO Y-PIPE JUNCTURE OF CATALYST INLET ON 3.0L EFI

Figure 1 Heated Exhaust Gas Oxygen Sensor (HEGO)

DIAGNOSIS

Refer to the EEC-IV Quick Test, Section 16.

TITLE	BASIC PART NO.	SYMBOL
Hot Idle Compensator	**9B532** **9E890**	HOT IDLE COMP VLV

DESCRIPTION

The hot idle compensator is used to cool the engine during extreme hot engine idle operation.

When open, the compensator bleeds air into the manifold, which leans out the fuel-air ratio at idle. The increased air intake causes an increase in engine idle speed, which results in cooling of the engine.

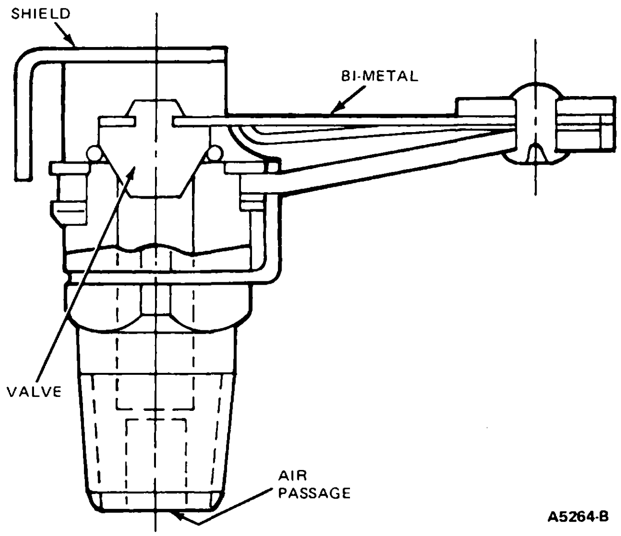


Figure 1 Hot Idle Compensator—Typical 9B532

DIAGNOSIS

The compensator may be internal or external to the carburetor.

Temperature on the bimetal lifts the normally closed valve and opens the air passage.

Valves open at a higher temperature and close at a lower temperature. This opening and closing range is from -12 to -7°C (10-20°F). Nominal closing temperatures vary from 26-60°C (79-140°F).

A compensator with a valve that is not fully closing can cause high idle speed and a high emission CO.

TITLE	BASIC PART NO.	SYMBOL
Ignition Barometric Pressure Switch	**12A243**	

DESCRIPTION

The Ignition Barometric Pressure Switch, Figure 1 is used to control spark timing and/or other electrical devices in response to changes in barometric pressure (i.e., altitude). When controlling spark timing, the ignition module (12A244) is made to vary the spark timing by an amount determined by calibration resistors in the switch assembly. In normal operation, spark timing is increased for vehicle operation above the switching point (increasing altitude) and retarded for vehicle operation below the switching point (decreasing altitude). When controlling other electrical devices, only On/Off control is provided; with On (switch closed) above the switching point and Off (switch open) below the switching point. Some switch assemblies control both spark timing and another device (dual switch assembly) and other switch assemblies control only one or the other (single switch assembly).

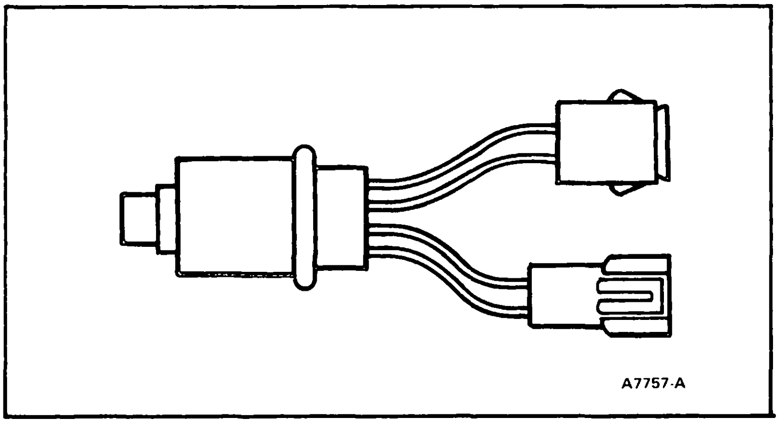


Figure 1 Ignition Barometric Pressure Switch

DIAGNOSIS

- Dual switch assembly shown.
- Attaching brackets vary according to installation requirements.
- Connectors may vary.

Part Number	Resistance (Ohms) Below 3,000 Feet	Resistance (Ohms) Above 4,600 Feet
E2AE-12A243-AA	Greater than 200,000	Less than 1
E43E-12A243-AA	2,820-2,920	1,750-1,850
E4DE-12A243-AB	2,560-2,660	1,960-2,060
E4EE-12A243-AA	Greater than 200,000	Less than 1

CA6843-D

***Either resistance value is correct if altitude is between 3,000 and 4,600 feet.**

TITLE	BASIC PART NO.	SYMBOL
Inertial Switch	**9341**	

DESCRIPTION

The inertia Switch, Figure 1, is used in conjunction with an electric fuel pump. The purpose of the inertia switch is to shut off the fuel pump in the event of an accident. It consists of a steel ball held in place by a magnet. When a sharp impact occurs, the ball breaks loose from the magnet, rolls up a conical ramp and strikes a target plate which opens the electrical contacts of the switch and thereby shuts off the electric fuel pump. Once the switch is open, it must be manually reset before re-starting the vehicle. The location of the switch is discussed in the owners guide.

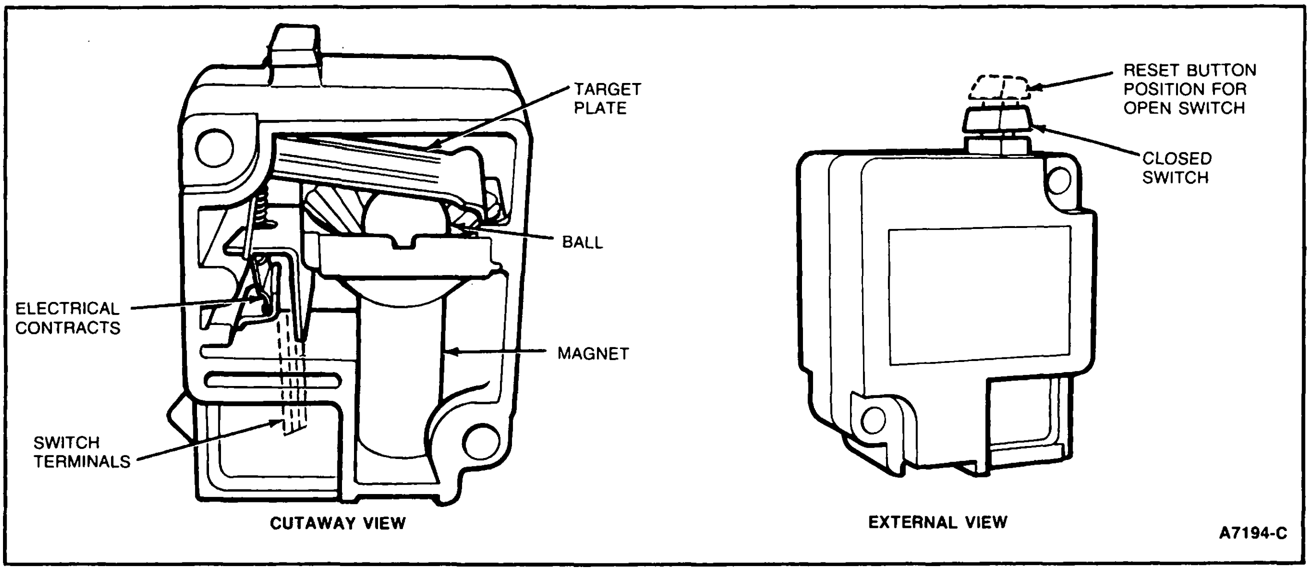


Figure 1 Inertia Switch

DIAGNOSIS

RESET INSTRUCTIONS

1. Turn ignition to Off.
2. Check for leaking fuel in the engine compartment, fuel lines and tank(s).
3. If no fuel leak is apparent, reset the switch by pushing the reset button on the top of the switch.
4. Turn ignition switch to Start for a few seconds, then to Off.
5. Again, check for leaking fuel.

WARNING: If you see or smell gasoline at any time other than during fueling, do not reset the switch.

Functional Check

Push down on the reset button to make sure the switch is closed.

Use DVOM, Rotunda 007-00001 or equivalent, with LOS button On and measure voltage across both terminals of the inertia switch. If DVOM reading is greater than 0.3V, replace the inertia switch.

NOTE: In the closed position, the button can be depressed an additional 1/16-inch against a spring. This is a normal condition and does not adversly effect the switch operation.

TITLE	BASIC PART NO.	SYMBOL
Integral Relay Control Module	**12B577**	

DESCRIPTION

The Integral Relay Control Module (IRCM) interfaces with the EEC-IV to provide control of the cooling fan, A/C clutch and the fuel pump. The module also incorporates the EEC power relay to provide power to the EEC-IV system.

The module is designed specifically for underhood application. The limits of operation are as follows:

Operating Temperature ....-30°C to 100°C
Storage Temperature ....-40°C to 125°C
Operating Voltage ....7 to 17 volts

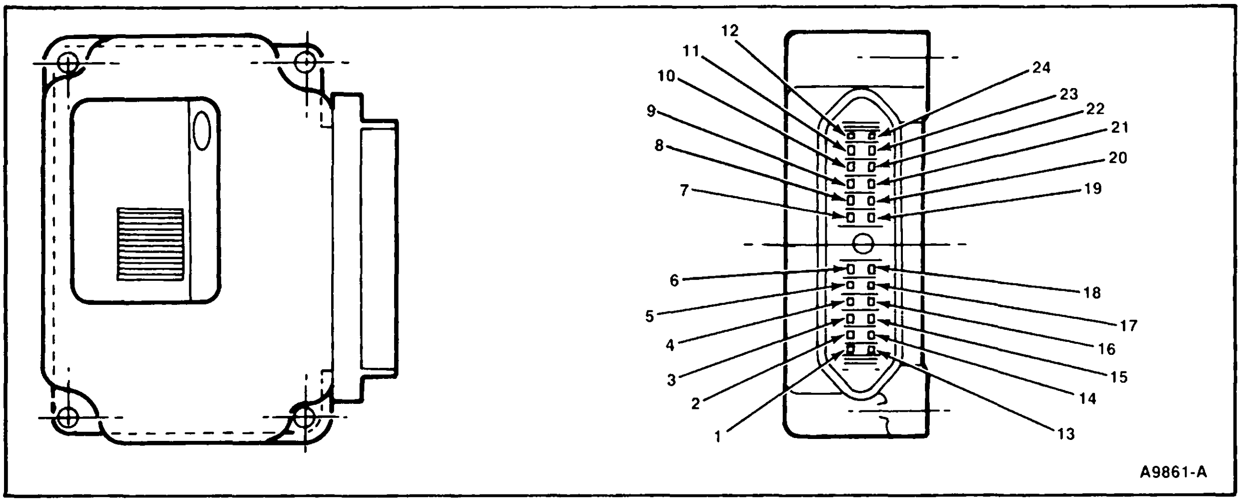


Figure 1 Integral Relay Control Module

DIAGNOSIS

Refer to EEC-IV Quick Test, Section 16.

Powertrain/Model Application	Controller -12B577-	Bracket and Control Assembly —12B581-	Vehicle Location
2.3L TC M/T and A/T Thunderbird	E7DF-CB	E7SF-AA	RHS Fender Apron at Shock Tower
2.5L HSC M/T Taurus	E7DF-BB	E7DF-BA	Radiator Support
2.5L HSC A/T Taurus/Sable	E7DF-AB	E7DF-AA	Radiator Support
3.0L A/T Taurus/Sable	E7DF-CB	E7DF-CA	Radiator Support
3.8L A/T Taurus/Sable	E7DF-CB	TBD	Radiator Support

TITLE	BASIC PART NO.	SYMBOL
Knock Sensor	**12A699**	

DESCRIPTION

The Knock Sensor, (Figure 1), is a piezoelectric accelerometer with the sensor designed to resonate at approximately the same frequency as the engine knock frequency. The sensor uses the resonant frequency to mechanically amplify the vibrations. This method allows relatively large signals to be achieved without electrical amplification and with small package size.

The sensor has a thin circular piezoelectric ceramic disk which is bonded to a metal diaphragm. Electrical connections are made through a two pin integral connector.

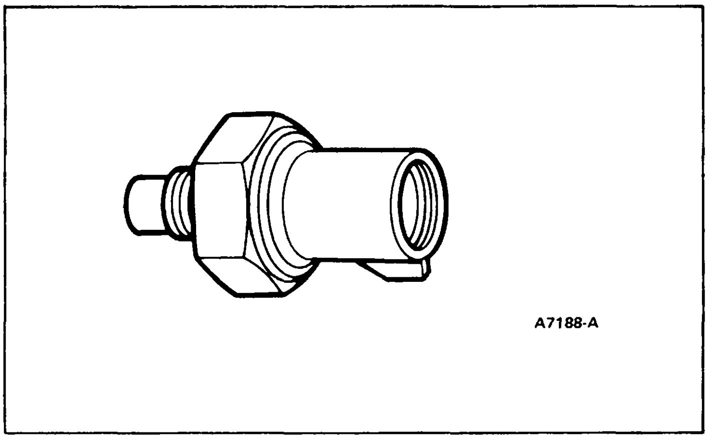


Figure 1 Knock Sensor

DIAGNOSIS

Refer to the EEC-IV Quick Test, Section 16.

Part Number	Resonant Frequency	Color	Planned Usage	Thread
E3AF-AA	5.4K	Black	5.8L Ford/Mercury	1/2-13 UNC
E3ZSF-AA	5.7K	Gray	2.3L (Turbo) Thunderbird	M12 x 1.5mm-6g
E6TF-AA	6.45K	Black	2.9L Ranger/Bronco II	M10 x 1.5mm-6g
E5TF-AA	6.OK	Black	3.0L Taurus/Sable, Aerostar	M10 x 1.5mm-6g
E7TF-AA	9.5K	White	4.9L Econoline/Bronco	M12 x 1.5mm-6g

TITLE	BASIC PART NO.	SYMBOL
Manifold Pressure Warning Indicator Switch Assembly	**10D883**	

DESCRIPTION

Turbocharged Vehicles Only

The switch assembly has a pressure switch to trigger the over-boost lamp (red) and a buzzer on the instrument panel (Figure 1).

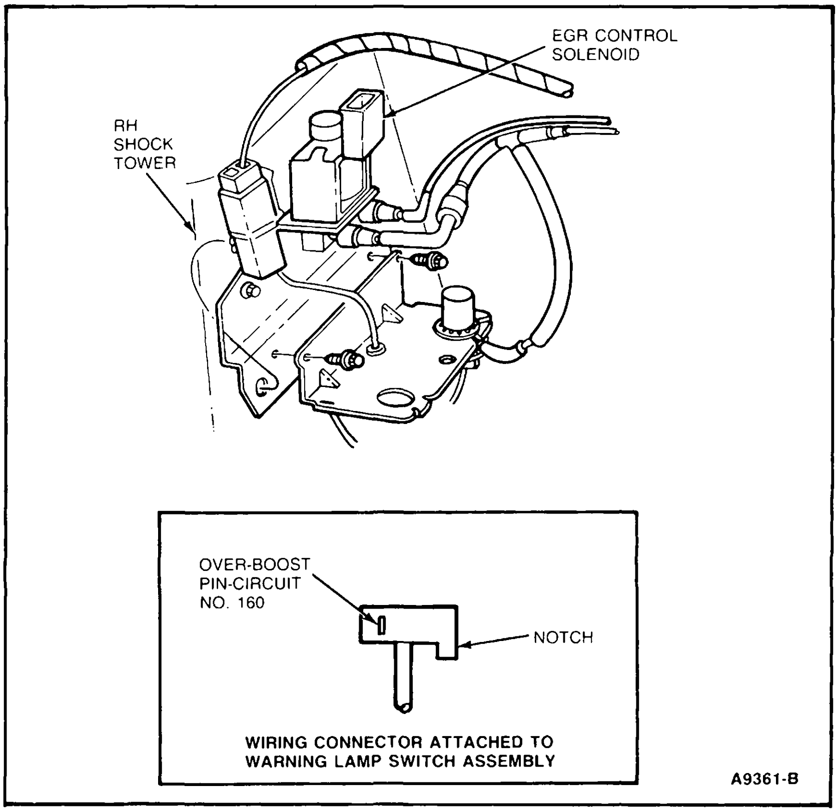

EGR CONTROL SOLENOID
RH SHOCK TOWER
OVER-BOOST PIN-CIRCUIT NO. 160
NOTCH
WIRING CONNECTOR ATTACHED TO WARNING LAMP SWITCH ASSEMBLY
A9361-B

Figure 1 Manifold Pressure Warning Indicator Switch Assembly

DIAGNOSIS

Disconnect the wiring harness connector from the warning lamp switch assembly. Using a test lamp or equivalent device, determine if the pin is connected to ground when pressure is applied as follows:

1. Over-boost lamp switch check: The other pin on the connector, joining to Circuit 160, should be connected to ground when a pressure of 17.5 psi or greater is applied.

TITLE	BASIC PART NO.	SYMBOL
Pressure Feedback Electronic EGR Valve	**9D460**	

DESCRIPTION

The Pressure Feedback Electronic (PFE) EGR valve is a conventional ported EGR valve with a backpressure sensing tube attached to it. The valve is used in conjunction with a pressure transducer (9J460) which supplies pressure feedback to the EEC-IV processor. The EGR flow rate is proportional to the pressure drop across a remotely mounted sharp edged orifice.

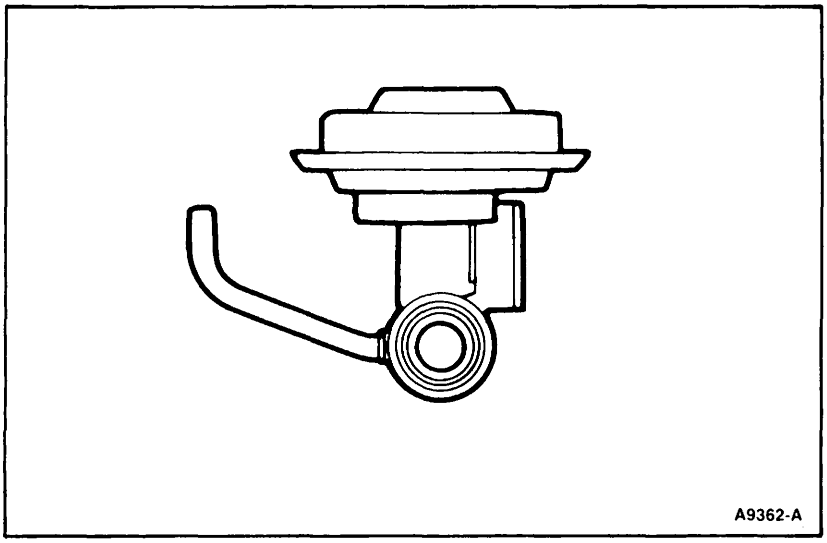


Figure 1 Pressure Feedback Electronic EGR Valve

DIAGNOSIS

Refer to Section 6, Exhaust Gas Recirculation (EGR) System.

TITLE	BASIC PART NO.	SYMBOL
Pressure Feedback Electronic EGR Transducer	**9J460**	

DESCRIPTION

The Pressure Feedback Electronic (PFE) EGR transducer converts a varying exhaust pressure signal into a proportional analog voltage which is digitized by the EEC-IV processor. The EEC-IV processor uses the signal received from the PFE transducer to complete the optimum EGR flow.

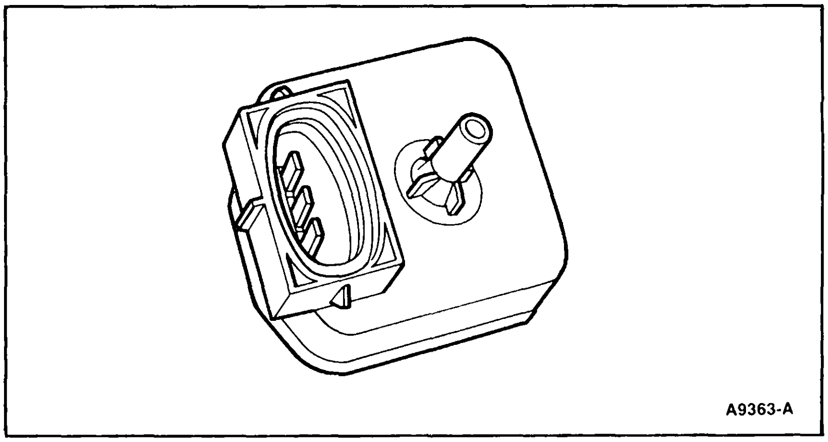


Figure 1 Pressure Feedback Electronic EGR Transducer

DIAGNOSIS

Refer to the EEC-IV Quick Test, Section 16.

TITLE	BASIC PART NO.	SYMBOL
Relay Assembly EEC (Power) **EEC (Power) Time Delay**	**12A646**	

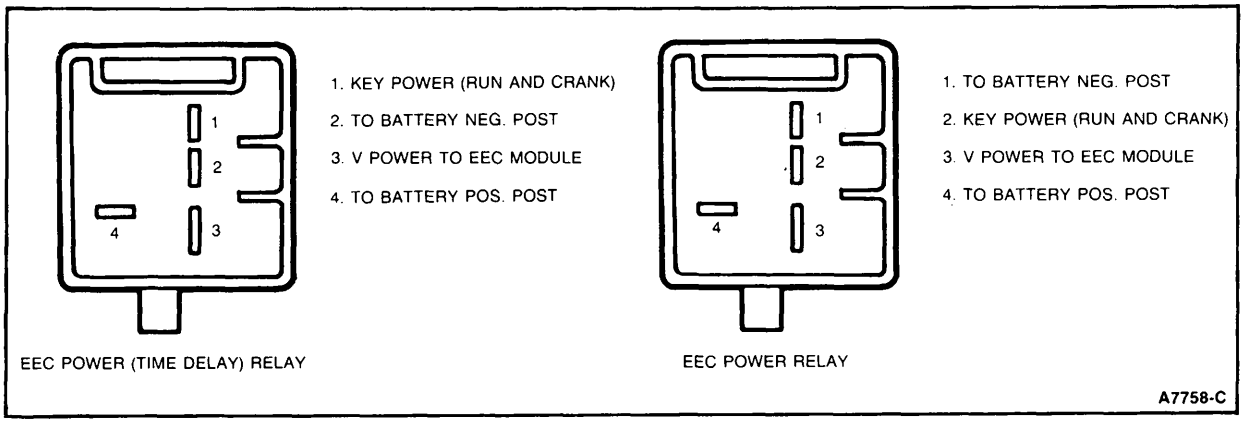
DESCRIPTION

There are two types of relays: the power relay and the time delay power relay. The time delay relay has a delay of 5 to 10 seconds and is used with an actuator assembly throttle control. Both relay types consist of a movable contact in the normally open position. All power relays (except time delay) have the same design with a different bracket attachment.

Function

EEC power relays are in parallel with the ignition switch and provide power to the EEC module. Power relays also provide reverse battery protection and increased load handling to improve ignition switch reliability.

Specifications	Time Delay Power Relay	Power Relay
Pull-in Voltage	9 V DC max	8.5V DC max
Millivolt Drop	15 mv/amp	10 mv/amp
Coil Current	220 ma@14.4V DC	220 ma@12.8V DC
Drop-out Voltage	4.5 V DC	1-4 V DC



EEC POWER (TIME DELAY) RELAY

EEC POWER RELAY

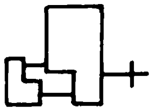
Figure 1 Relay Assembly

TITLE	BASIC PART NO.	SYMBOL
Relay Assembly EEC (Power) **EEC (Power) Time Delay**	**12A646**	

EEC POWER RELAY LOCATION AND APPLICATIONS

PART NUMBER AND RELAY TYPE (Power or Time Delay)	SYSTEM APPLICATION(S)	LOCATION(S)
o E6EF-12A646-B1A/B2A Power Relay	Escort/Lynx/EXP 1.9L EFI	Passenger compartment under dash on module bracket.
o E3UF-12A646-B1A/B2A Power Relay	Econoline 4.9L/5.0L EFI	— Under dash on module bracket. — Under dash on right cowl.
o E3VF-12A646-B1A/B2A Power Relay	Ranger/Bronco II 2.3L EFI Bronco II/Ranger 2.9L EFI	Engine compartment.
o E35F-12A646-B1A/B2A Power Relay	Thunderbird/Cougar 3.8L EFI Mustang 3.8L EFI Thunderbird/Cougar/Mustang 5.0L SFI Mustang 2.3L OHC EFI	Passenger compartment under dash on right cowl assembly.
o E3AF-12A646-B1A/B2A Power Relay	Ford/Mercury 5.0L SFI Lincoln Town Car 5.0L SFI Continental/Mark VII 5.0L SFI Aerostar 2.3L/3.0L EFI F-Series/Bronco 4.9L/5.0L	Engine compartment doghouse.
o E3AF-12A646-B1A/B2A Power Relay	Heavy Truck 7.5L (87 1/2 Model Year)	Engine compartment doghouse.
o E7EF-12A646-A1A Time Delay	Escort/Lynx/EXP 1.9L CFI	Passenger compartment under dash on right cowl assembly.
o E4DF-12A646-A1A Time Delay	Thunderbird/Cougar 3.8L CFI Mustang 3.8L CFI	Passenger compartment under dash on right cowl assembly.
o E53F-12A646-A1A Time Delay	Tempo/Topaz 2.3L HSC CFI	Passenger compartment under dash behind glove compartment.

CA9862-A

TITLE	BASIC PART NO.	SYMBOL
Solenoid Vacuum Valve Assembly	**9D474**	 SOL V

DESCRIPTION

Normally Closed

The normally closed solenoid valve assembly, Figure 1 consists of two vacuum ports with an atmospheric vent. The valve assembly can be with or without control bleed. The outlet port of the valve is opened to atmospheric vent and closed to the inlet port when de-energized. When energized, the outlet port is opened to the inlet port and closed to atmospheric vent. The control bleed is provided to prevent contamination entering the solenoid valve assembly from intake manifold. This solenoid valve assembly is used on Throttle Kicker, Air Dump, Air Diverter Control Systems and Exhaust Heat Control Valve Systems.

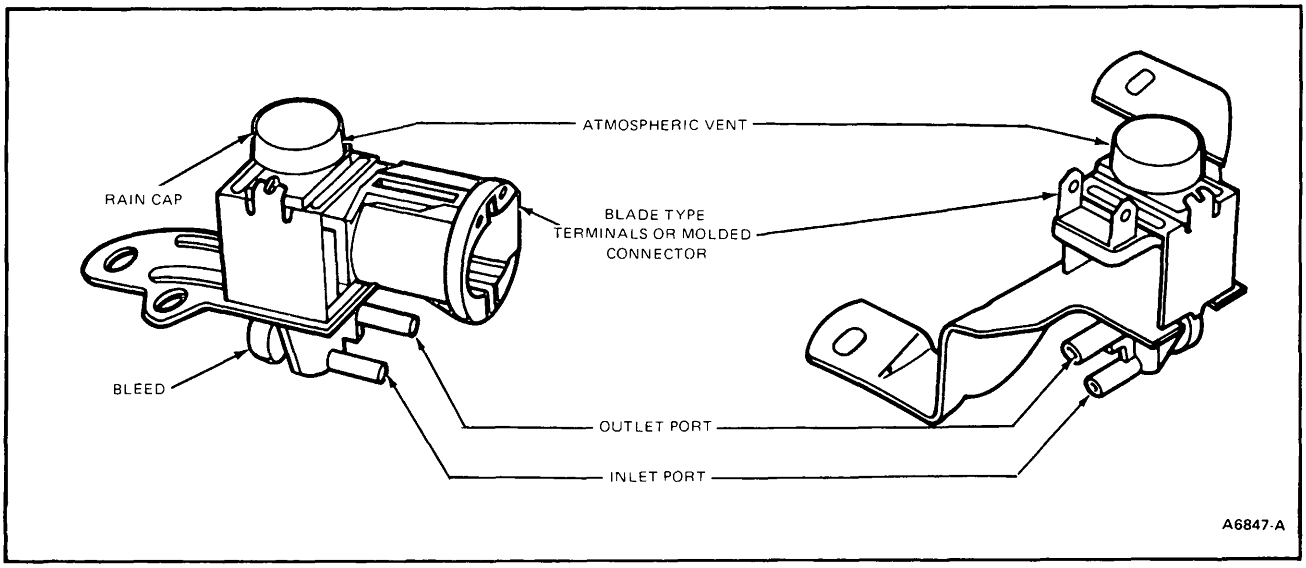


Figure 1 Typical Solenoid Valve Assembly—Normally closed

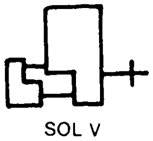
DIAGNOSIS

The ports should flow air when the solenoid is energized.

The solenoid resistance when checked at the terminals should be between 51 and 108 ohms. If the solenoid resistance is not within these values, the solenoid should be replaced.

Refer to the EEC-IV Quick Test, Section 16.

NOTE: The valve can be expected to have a very small leakage rate when energized or de-energized. This leakage is not measurable in the field and is not detrimental to valve function.

TITLE	BASIC PART NO.	SYMBOL
Solenoid Vacuum Valve Assembly Combinations	**9D474**	

DESCRIPTION

Normally Open and Normally Closed

The solenoid valves operate independently and each controls different devices. They are, however, mounted on a single bracket.

The valves, Figure 2 are used for Thermactor Air Bypass and Thermactor Diverter.

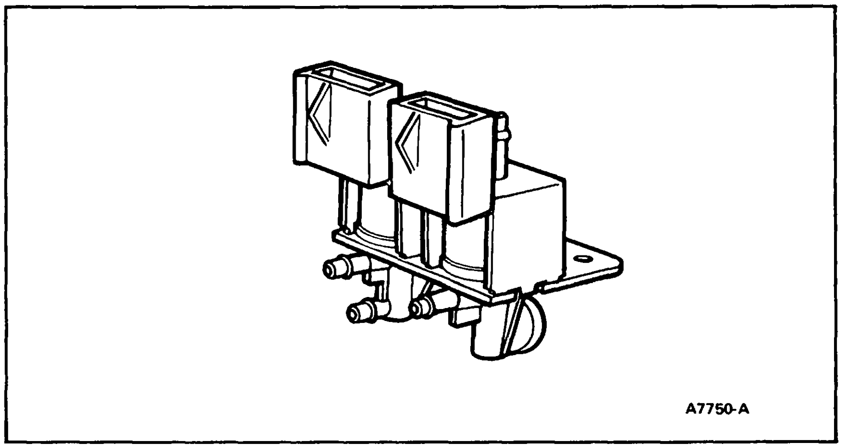


Figure 2 Normally Open and Normally Closed Valve Assembly Combinations

The one-port, normally open and the two-port normally closed solenoid valve assembly, Figure 3 is used for choke pull-down and A/C throttle kicker.

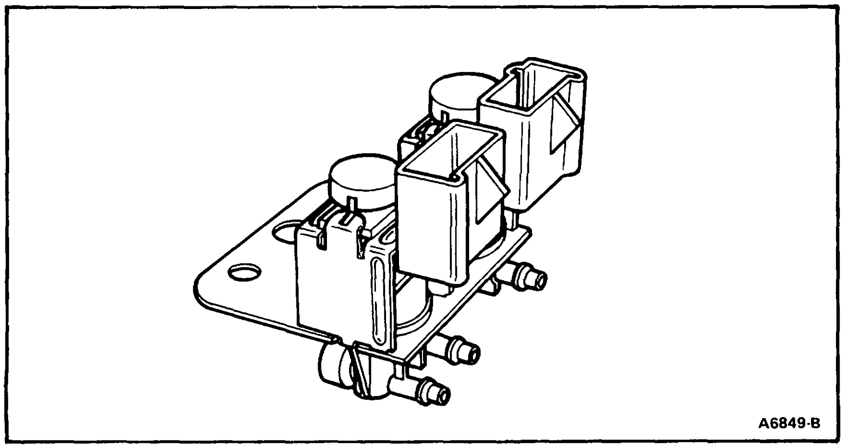


Figure 3 One-Port, Normally Open and Two-Port Normally Closed Solenoid Valve Assembly

TITLE	BASIC PART NO.	SYMBOL
Temperature Vacuum Switch	**9A995**	TVS

DESCRIPTION

The bimetal disc in the switch orients itself in one of two positions, depending on its temperature. One position allows free airflow in the vacuum line; the other position blocks airflow by sealing itself against the O-ring.

This device is mounted remotely to or directly on the air cleaner. It responds to the temperature of the inlet air heated by the exhaust manifold.

The switching temperature is below the range of normal, stabilized engine operating temperatures.

The TVS may be used to control the vacuum signal to the Thermactor dump valve, reducing emissions.

The normally open TVS may block the purge vacuum signal to provide satisfactory cold drive ability and reduce cold emissions. Also, the EGR may be held off to provide satisfactory cold driveability.

The normally closed TVS may allow cold spark advance to provide satisfactory driveaway.

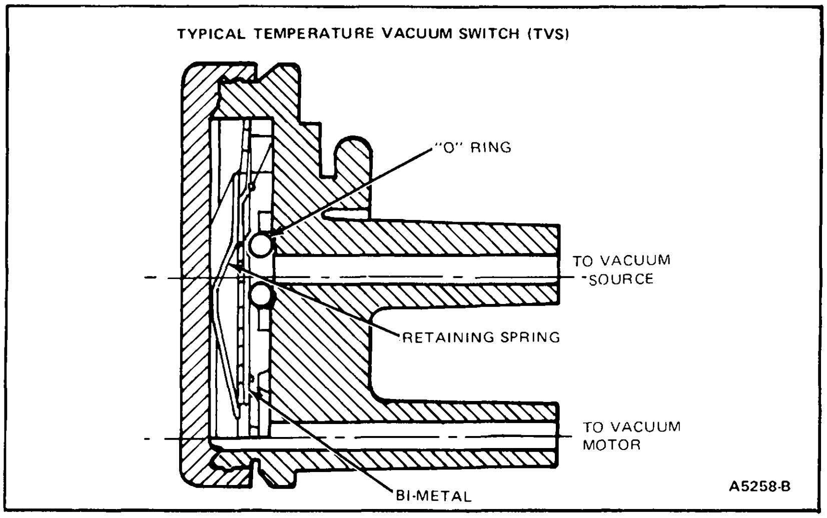
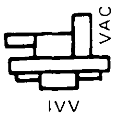


Figure 1 Temperature Vacuum Switch (TVS)

DIAGNOSIS

1. Apply 54 kPa (16 in.-Hg.) vacuum, using Rotunda Vacuum Tester 021-00014 or equivalent, to motor side and trap.
   a) With the white TVS cooled to 10°C (50°F), the normally open TVS must hold 16.9 kPa (5 in.-Hg.) for 30 seconds. The white TVS should not hold vacuum above 24.4°C (76°F).
   b) With the brown colored TVS cooled to -9.4°C (15°F), the normally open TVS must hold 16.9 kPa (5 in.-Hg.) for 30 seconds. The brown TVS should not hold vacuum above -1.1°C (30°F).
   c) The normally closed, red TVS should not hold vacuum at or below 10°C (50°F), however, it must hold 16.9 kPa (in.-Hg.) vacuum for 30 seconds above 18.3°C (60°F).
   d) With the purple TVC cooler to 4.4°C (40°F), the normally open TVS must hold 16.9 kPa (5 in.-Hg.) for 30 seconds, the purple TVS should not hold vacuum above 12.8°C (55°F).

TITLE	BASIC PART NO.	SYMBOL
Thermactor Idle Vacuum Valve	**9G328**	

DESCRIPTION

The TIV valve vents the vacuum signal to the atmosphere when the preset manifold vacuum or pressure is exceeded. It is used to divert Thermactor airflow during extended idle conditions to limit exhaust temperature and to cut EGR in a heavy boost mode for turbocharged applications.

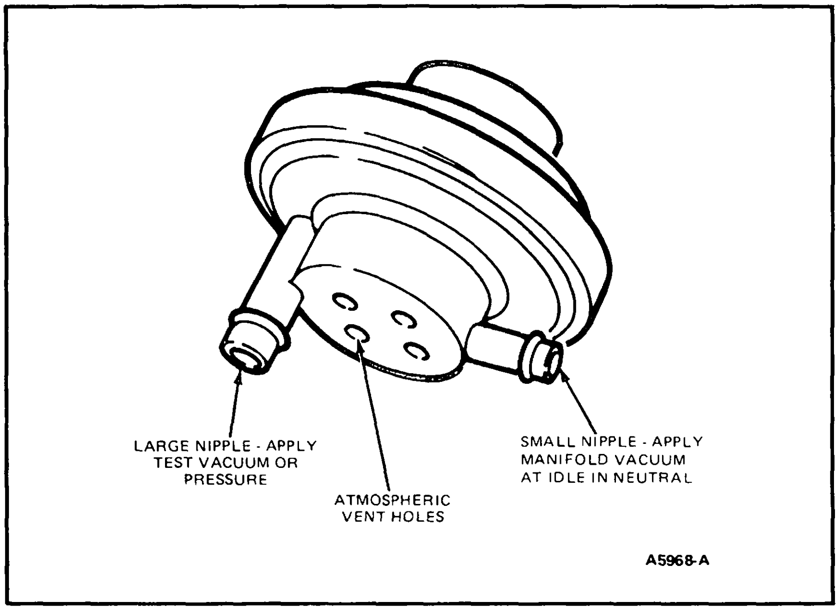
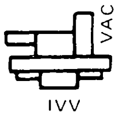

LARGE NIPPLE - APPLY TEST VACUUM OR PRESSURE
ATMOSPHERIC VENT HOLES
SMALL NIPPLE - APPLY MANIFOLD VACUUM AT IDLE IN NEUTRAL
A5968-A

Figure 1 Thermactor Idle Vacuum Valve

Functional Checks

Conditions

- Disconnect both nipples of the Thermactor Idle Vacuum (TIV) valve.
- Install a vacuum hose from the manifold vacuum source to the small nipple of the TIV valve.

TITLE	BASIC PART NO.	SYMBOL
Thermactor Idle Vacuum Valve	**9G328**	

Checks

TIV valves with code words ASH or RED on decal:

1. With the engine at idle, in Neutral, place fingers over the TIV valve atmospheric vent holes, refer to Figure 1. If no vacuum is sensed, the TIV is damaged and must be replaced.
2. While the engine is still idling in neutral, apply vacuum, shown below, to the TIV valve large nipple from a test source. If vacuum is still sensed when placing fingers over vent holes, the TIV is damaged and must be replaced.
3. Disconnect the TIV large nipple from manifold vacuum and the TIV small nipple from the test vacuum. Reconnect the TIV valve to original hoses or connectors.

TIV valves with code mode TUR on decal:

TIV Decal Code Mode	Vacuum kPa (In. Hg.)
Ash	5.1 (1.5) — 10 (3.0)
Red	11.8 (3.5) — 15.2 (4.5)

TIV Decal Code Mode	Pressure: kPa (In. Hg.)
TUR	5.1 (1.5) — 8.5 (2.5)

CA5985-C

1. With the engine at idle, transmission in Neutral, place fingers over TIV valve atmospheric vent holes (Figure 1). If vacuum is sensed, the TIV is damaged and must be replaced.
2. While the engine is still idling in Neutral, apply pressure, shown below, to the TIV valve's large nipple from a test source. If vacuum is not sensed when placing a finger over the vent holes, the TIV is damaged and must be replaced.
3. Disconnect the TIV valve's large nipple from manifold vacuum and the small nipple from the test pressure. Reconnect the TIV to its original hoses or connectors.

TITLE	BASIC PART NO.	SYMBOL
Throttle Position Sensor (Rotary)	**9B989**	

DESCRIPTION

The Throttle Position (TP) Sensor (Rotary), Figure 1, supplies the ECA with a signal proportional to opening angle of carburetor throttle plates.

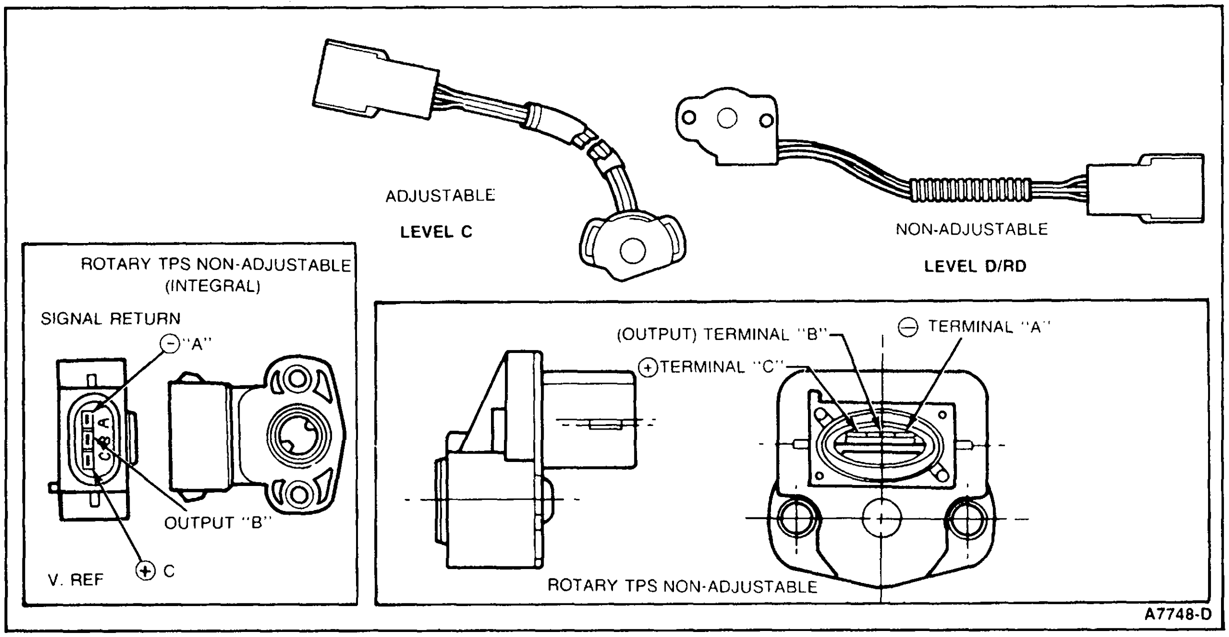


Figure 1 Throttle Position (TP) Sensor (Rotary)

ADJUSTMENT

This procedure can be used to check and/or adjust level C sensors only:

1. Install an EEC-IV Breakout Box, Rotunda T83L-50 EEC-IV, or equivalent.
2. Attach a DVOM, Rotunda 014-00407 or equivalent, on 20V scale. Connect the positive lead (+) to test Pin 47 and the negative lead (—) to test Pin 46.
3. Turn ignition key to Run position, (do not start engine).
4. Adjust TP Sensor (rotate) until the DVOM reads 1.0V (0.9-1.1).
5. Tighten TP Sensor screws to 1.2-1.8 N·m (11-16 lb-in).
6. While watching the DVOM, move the throttle to wide open and back to idle position. For proper operation, the DVOM should move from 1.0 to at least 4.0 and back to 1.0V.
7. Perform EEC-IV Quick Test, Section 16.

DIAGNOSIS

Refer to the EEC-IV Quick Test, Section 16.

TITLE	BASIC PART NO.	SYMBOL
Throttle Solenoid Positioner With Dashpot		

DESCRIPTION

The Throttle Solenoid Positioner (TSP) with or without Dashpot combines the features of the throttle solenoid positioner (TSP) and the dashpot by attaching a dashpot to the end of the TSP plunger.

The TSP acts as a variable carburetor throttle stop by extending its plunger when power is supplied to the solenoid and by retracting the plunger when power is turned off. When the TSP is energized, it will hold the throttle at an idle position, but, as soon as it is de-energized at the ignition switch, the TSP will function like an anti-dieseling device by automatically retracting its plunger into an anti-dieseling position, fully closing the throttle.

A TSP may also be used to increase the throttle opening when the air conditioning is turned On.

The dashpot is used on certain applications when a gradual, controlled throttle closing is desired, either for emission purposes or vehicle driveability.

Two kinds of TSPs with a dashpot are used: the fixed plunger rod length type and the adjustable plunger rod length type.

The TSP with a dashpot is not strong enough to open the throttle but will hold it open after it has been mechanically opened.

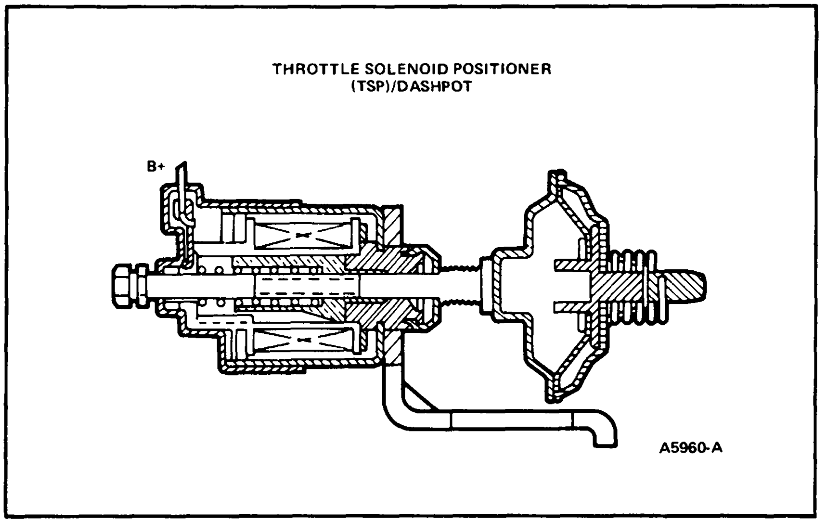


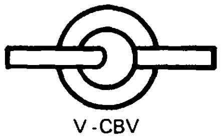
Figure 1 Throttle Solenoid Positioner with Dashpot

DIAGNOSIS

With the throttle open and the solenoid electrically energized, the plunger should extend.

Push the dashpot plunger into the collapsed position, and if no resistance is felt or if excessive force is required to bottom the plunger, the dashpot is damaged.

If either component fails, replace the assembly.

TITLE	BASIC PART NO.	SYMBOL
Vacuum Bowl Vent Valve & Vacuum/Thermostatic Bowl Vent Valve	**9G332**	

DESCRIPTION

The Vacuum Bowl Vent Valve and the Vacuum/Thermostatic Bowl Vent Valve are vacuum and vacuum/temperature actuated On/Off valves.

The Vacuum Bowl Vent Valve (E3TE-9G332-AA), Figure 2 and the Vacuum Thermostatic Bowl Vent Valve (E3EE-9G332-AA), Figure 1, are similar in appearance. The valves are used in the Evaporative Emission System to control vapor flow from the carburetor bowl to the carbon canister. With either valve, the flow path from the bowl to the canister is closed by manifold vacuum when the engine is running. The thermostatic valve also closes the bowl-to-canister flow path when the temperature of the valve is 90°F or less (even without manifold vacuum). When the temperature of the valve is 120°F or more, the valve is open (unless closed by manifold vacuum).

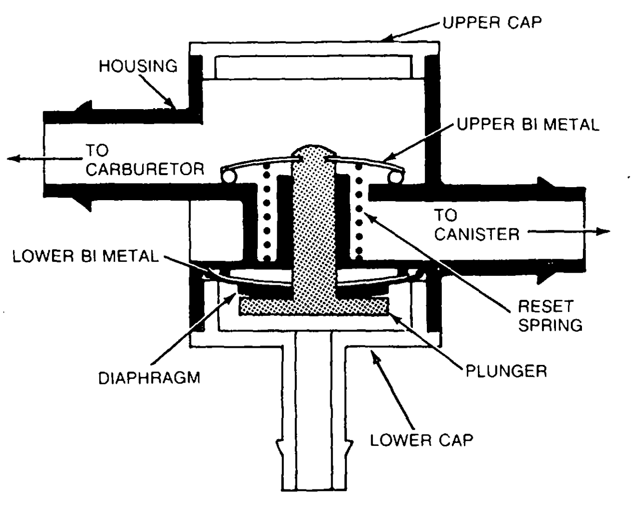


Figure 1 Vacuum/Thermostatic Bowl Vent Valve

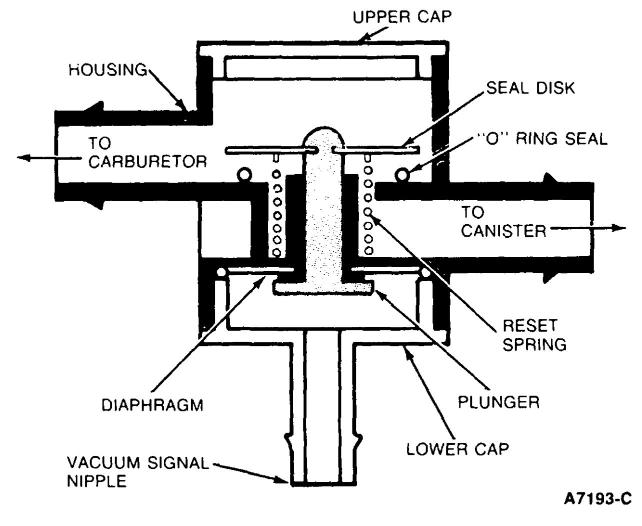


Figure 2 Vacuum Bowl Vent Valve

TESTING

The Vacuum Vent Valve (E3TE-9G332-AA), Figure 2 should flow air between carburetor port and canister port when no vacuum is applied to vacuum signal nipple and should not flow air with a vacuum applied at the vacuum signal nipple.

The above test also applies to the Vacuum/Thermostatic Vent Valve (E3EE-9G332-AA), Figure 1 when it is at a temperature of 120°F or more. At a temperature of 90°F or less the valve should not flow air, or be very restrictive to airflow.

The Evaporative Emission System is discussed in Section 7.

TITLE	BASIC PART NO.	SYMBOL
Vacuum Check Valve	**12A197**	 VCK-V

DESCRIPTION

A vacuum check valve (Figure 1) blocks airflow in one direction. It allows free airflow in the other direction. The check side of this valve will hold the highest vacuum seen on the vacuum side. If not, replace it.

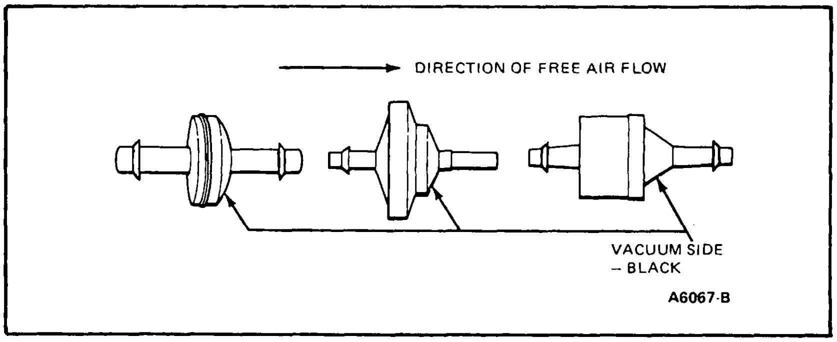
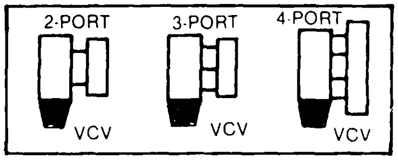


Figure 1 Vacuum Check Valve

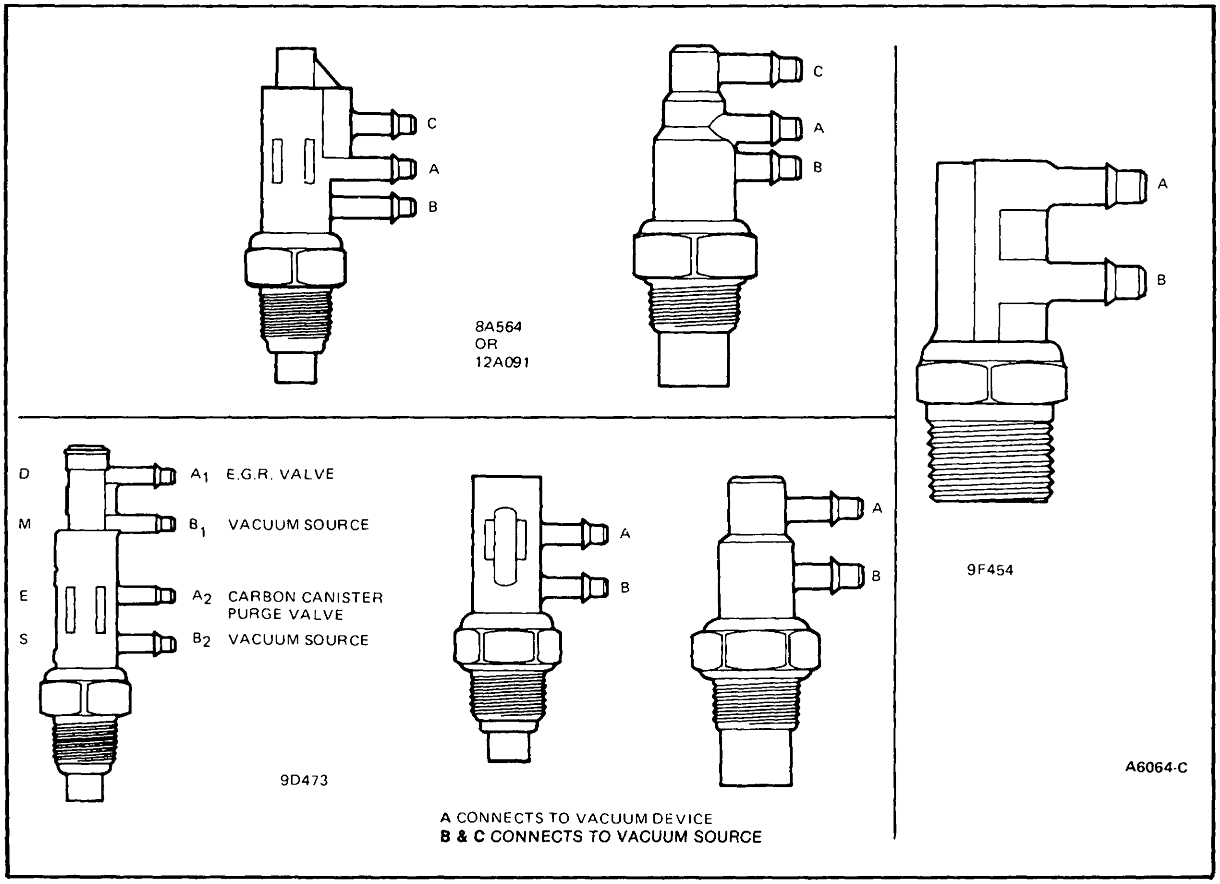
DIAGNOSIS

Apply 54 kPa (16 in.-Hg.) vacuum to "check" side of valve and trap. If vacuum remains above 50.6 kPa (15 in.-Hg.) for 10 seconds, the valve is acceptable.

TITLE	BASIC PART NO.	SYMBOL
Vacuum Control Valve	**8A564** **9D473** **9F454** **12A091**	

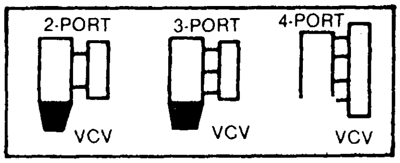
DESCRIPTION

The VCV controls vacuum to other emission devices during engine warm-up: the 2-port types simply open when engine coolant reaches their pre-determined calibration temperatures; the 4-port types open likewise, since they are nothing more than two 2-port types in one housing; and the 3-port types switch the vacuum source to the center port from the top or the bottom ports. Electrical switches can be either open or closed until the VCV is fully cycled. Most VCV's respond to a sensing bulb immersed in engine coolant by utilizing a wax pellet principle. The only exception is the 9F454 which operates on a bimetal principle. Vacuum is usually sourced as illustrated in Figure 1.



A CONNECTS TO VACUUM DEVICE
B & C CONNECTS TO VACUUM SOURCE

Figure 1 2-, 3-, and 4-Port Vacuum Valves

TITLE	BASIC PART NO.	SYMBOL
Vacuum Control Valve	**8A564** **9D473** **9F454** **12A091**	

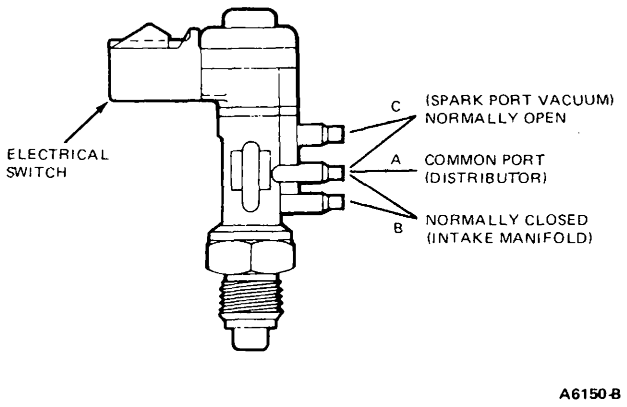
Functional Vacuum Check

1. With a cold engine, passage A to B should be closed and passage A to C should be open.
2. With engine at normal operating temperature, the VCV should be open between A and B and closed between A and C.

   For the 4-port valve, check A_1 to B_1 and A_2 to B_2 separately.
3. If these conditions are not met, replace the VCV Valve.

Electrical Vacuum Switch

The electrical vacuum switch (Figure 2) could be either opened or closed at room temperature. It will be reversed (opened to closed or closed to opened) with the engine at full operating temperature.

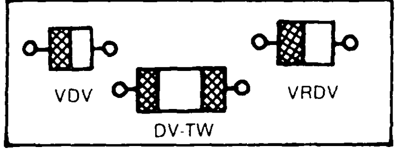


ELECTRICAL SWITCH
C (SPARK PORT VACUUM) NORMALLY OPEN
A COMMON PORT (DISTRIBUTOR)
B NORMALLY CLOSED (INTAKE MANIFOLD)
A6150-B

Figure 2 Electrical Vacuum Switch — 8A564

Functional Electrical Check

1. While the engine is cold, measure the continuity across the switch. Compare with specifications.
2. Warm the engine to normal operating temperature.
3. Measure the continuity across the switch. Compare with specifications.
4. The vacuum function is checked as previously described.

TITLE	BASIC PART NO.	SYMBOL
Vacuum Delay Valves	9E897 12A189 12A208 12A245	

DESCRIPTION

Vacuum Delay Valves (VDV) are used for a gradual application or release of vacuum to a vacuum-operated device to help control emissions. The four valves currently in use are illustrated below with an arrow to show the direction in which airflow is restricted (Figure 1). Note that, although each valve is named for a given system application, it may be used elsewhere.

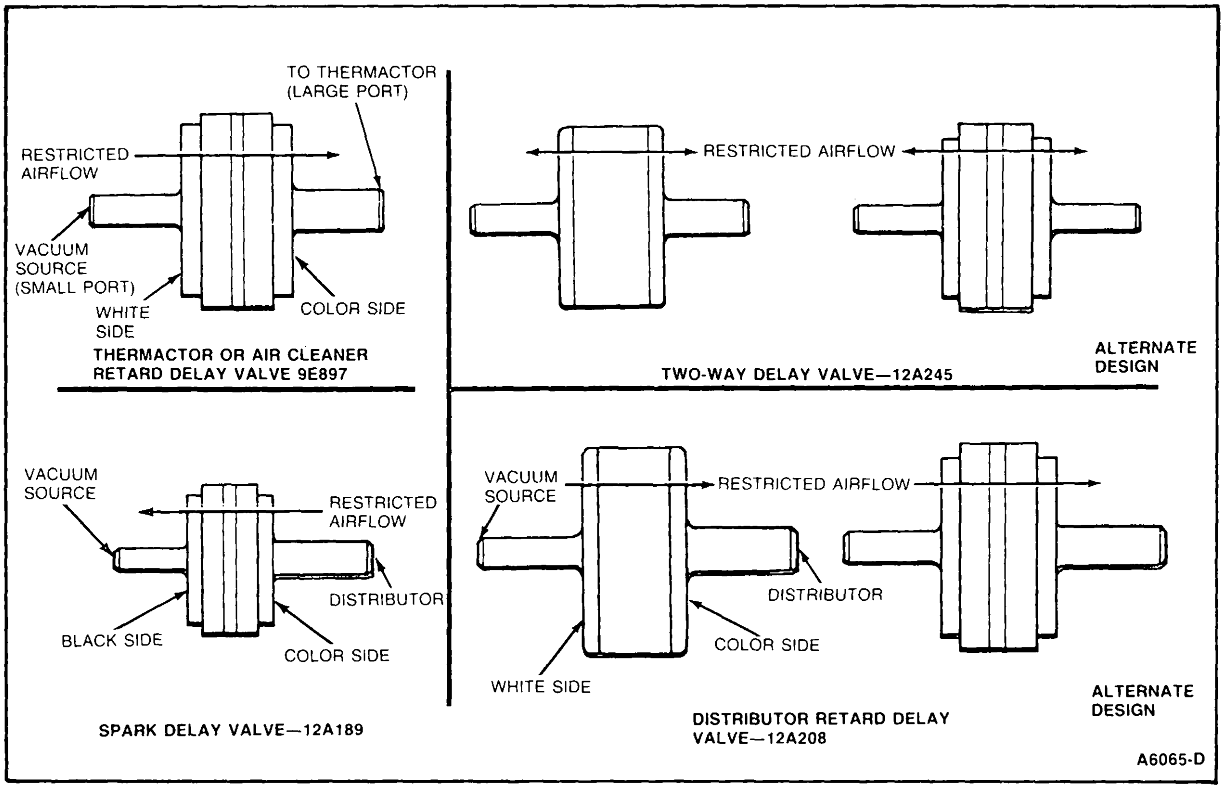
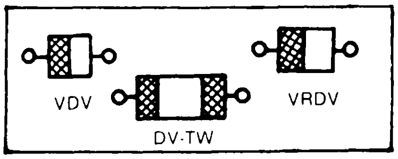


Figure 1 Four Types Of Vacuum Delay Valves

TITLE	BASIC PART NO.	SYMBOL
Vacuum Delay Valves	**9E897** **12A189** **12A208** **12A245**	

Functional Check

Connect a hand vacuum pump, Rotunda 021-00014 or equivalent, to the VDV as shown in Figure 2 and pump.

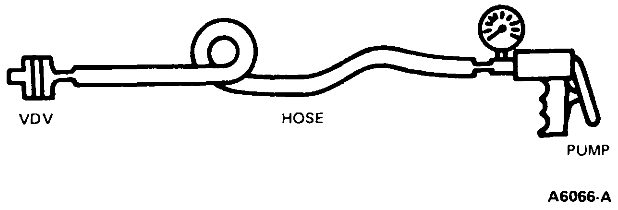


Figure 2 Hand Vacuum Pump Connection

1. Valves with one side black or white and the other side colored are good if vacuum can be built-up in one direction, but not the other direction and if that built-up vacuum can be seen to slowly decrease.
2. Valves with both sides the same color are good if vacuum can be built-up in both directions before visibly decreasing.

   NOTE: Exercise care in order to prevent oil or dirt from getting into the valve.

TITLE	BASIC PART NO.	SYMBOL
Vacuum Harness Assembly—Nylon	**9E498**	

DESCRIPTION

Engine vacuum systems currently use a pre-assembled harness which features colored nylon vacuum lines. The color is a visual aid both in production and in service. The emission decal on the engine provides a colored schematic of the vacuum hook-up which corresponds with the pre-assembled harness.

Vacuum hose harnesses consist of nylon hoses . . . 0.150-inch outer diameter and 0.090-inch inner diameter bonded to nylon or rubber connectors. Occasionally, a rubber hose may be connected to the harness. The nylon connectors have rubber inserts to provide a seal between the nylon connector and the component connection (nipple).

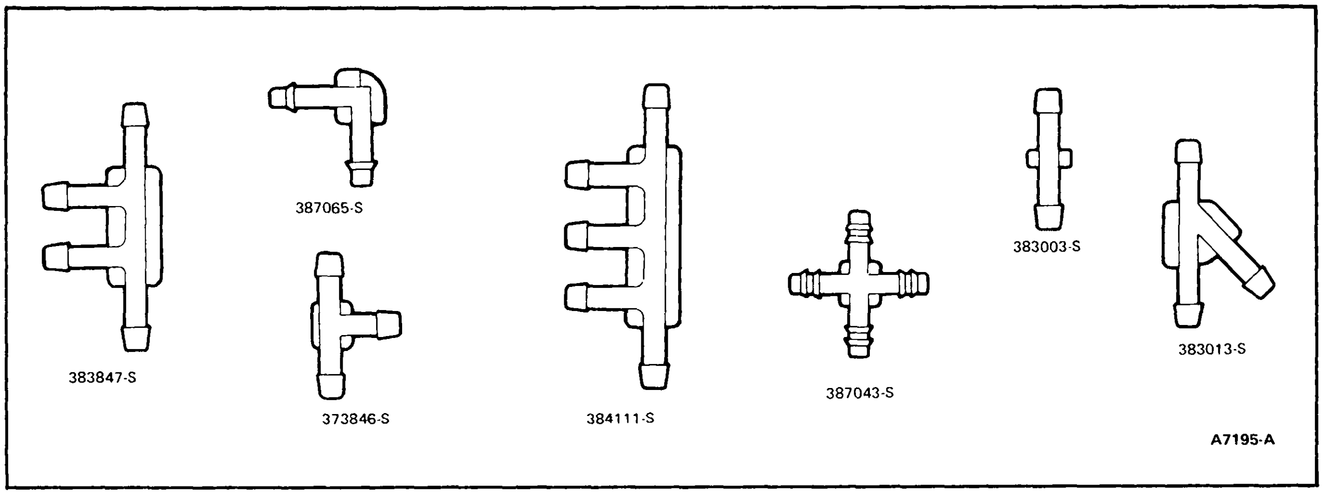


Figure 1 Vacuum Connectors Used With 5/32 Inch Rubber Hose for Service

TITLE	BASIC PART NO.	SYMBOL
Vacuum Harness Assembly—Nylon	**9E498**	

SERVICE REPAIR PROCEDURES

If a nylon tube is broken or kinked, and the damaged area is 1/2-inch or more from a connector; the tube can be repaired by cutting out the damaged section, but not more than 1/2-inch, and then installing a rubber union, Figure 2.

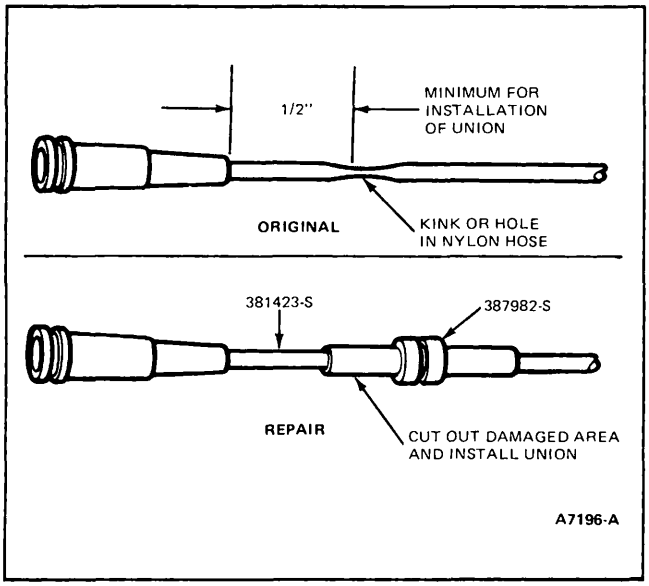

1/2"
MINIMUM FOR INSTALLATION OF UNION
ORIGINAL
KINK OR HOLE IN NYLON HOSE
381423-S
387982-S
REPAIR
CUT OUT DAMAGED AREA AND INSTALL UNION
A7196-A

Figure 2 Broken or Kinked Hose Repair

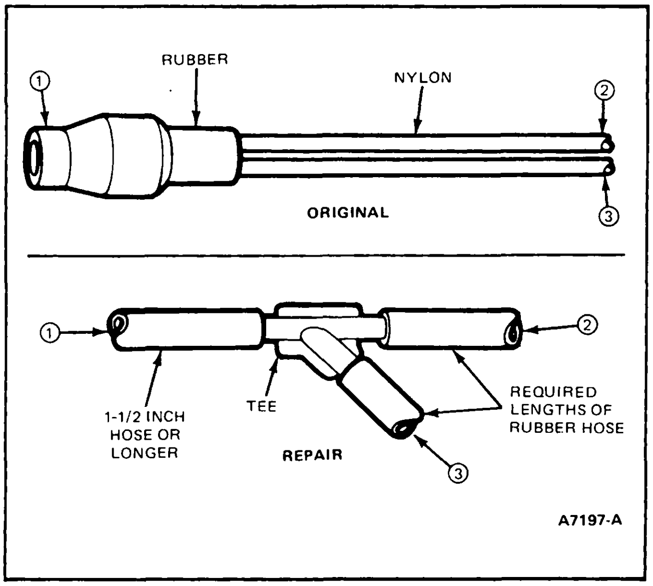


Figure 3 Hose Replacement

If the remaining hose is too short or the damaged portion is more than 1/2-inch: replace the entire hose and connectors with rubber vacuum hoses and a tee. Use existing service stock of 5/32-inch hose, 7/32-inch hose and tees.

NOTE: Circled numbers shown in Figure 3, identify same connection points on both original and repaired harnesses.

CAUTION: Care must be exercised to keep all vacuum parts away from hot components such as EGR tubes and exhaust manifolds. In addition, holes may be worn into the nylon hoses if allowed to rub against rough surfaces.

TITLE	BASIC PART NO.	SYMBOL
Vacuum Regulator (2-Port)	**9F490**	VRV

DESCRIPTION

The two port vacuum regulator (Figure 1) provides a constant output signal when the input signal is greater than a preset level. At a lower input vacuum, the output equals the input.

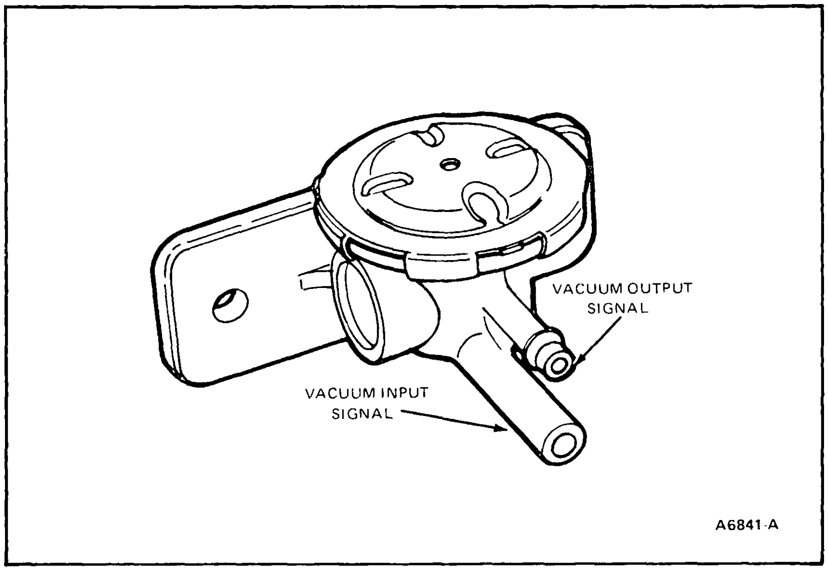


Figure 1 2-Port Vacuum Regulator

Functional Check

1. Remove vacuum line from the barbed output port (Figure 1), and install Rotunda Vacuum Gauge 059-00008 or equivalent.
2. With manifold vacuum at the input port and the engine at idle, the vacuum gauge should read between 35.7-45.9 kPa (10.5-13.5 in.-Hg.).
3. If the vacuum gauge reading is not within the specification, replace the regulator as required.

NOTE: The two port vacuum regulator is commonly attached to a 90-cubic inch vacuum reservoir.

TITLE	BASIC PART NO.	SYMBOL
Vacuum Regulator (3 & 4 Port)	**9F490**	VRV

DESCRIPTION

The three-port and four-port regulators are used to control the vacuum advance to the distributor. During engine idle conditions, the manifold vacuum signal is reduced to a constant output signal. Off idle, the output signal equals the spark port.

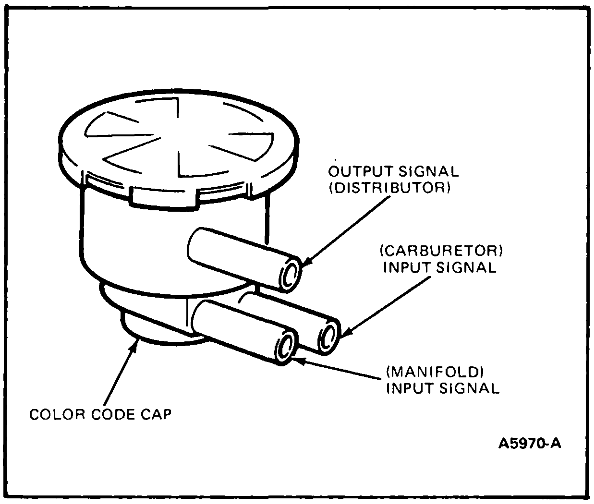


Figure 1 3-Port Vacuum Regulator

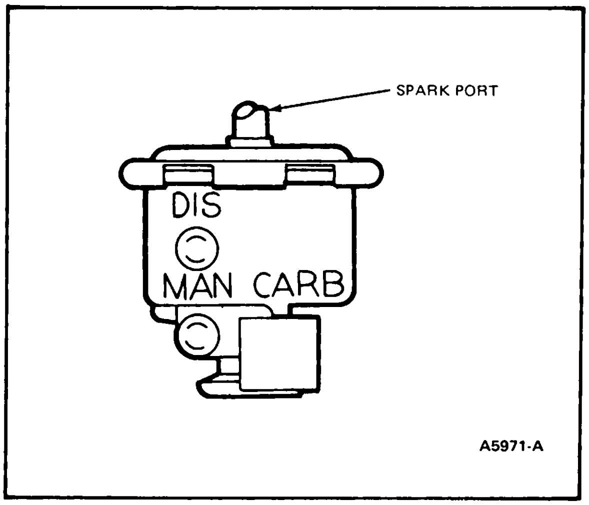


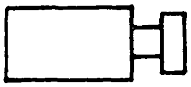
Figure 2 4-Port Vacuum Regulator

Functional Check

1. Remove the vacuum line from distributor port, and install a vacuum gauge (Figures 1 and 2).
2. With the engine at idle, the vacuum gauge reading should be within 3.4 kPa (1 in.-Hg.) vacuum of calibration point.
3. With the color codes different, vacuum readings are identified:
   - Black is 20 kPa (6 in.-Hg.)
   - Green is 23.6 kPa (7 in.-Hg.)
   - Red is 27 kPa (8 in.-Hg.)

   If the color code does not meet the respective vacuum reading, replace as required.

   NOTE: This procedure is applicable to both types of vacuum regulators.

TITLE	BASIC PART NO.	SYMBOL	
Vacuum Reservoir	**9E453**	 VRESER	 VRESER

DESCRIPTION

The Vacuum Reservoir, (Figure 1), stores vacuum and provides "muscle" vacuum. It prevents rapid fluctuations or sudden drops in a vacuum signal such as those seen during an acceleration period.

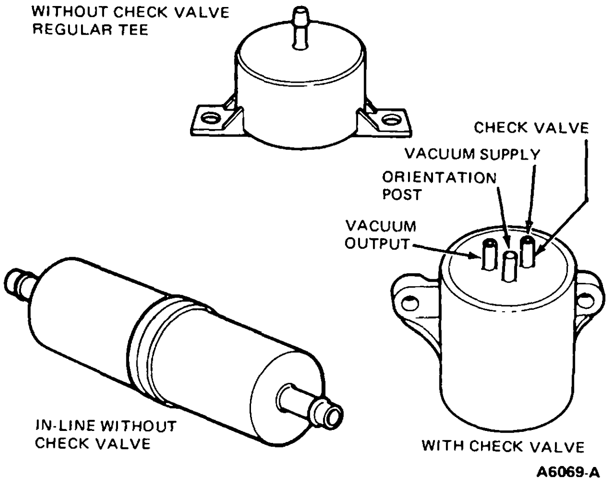
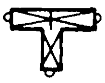


Figure 1 Vacuum Reservoirs

DIAGNOSIS

When charged initially with 15 to 20 in.-Hg. vacuum, vacuum loss shall not exceed .5 in.-Hg. in 60 seconds. If it does, replace the reservoir.

TITLE	BASIC PART NO.	SYMBOL	
Vacuum Restrictor	**12A225**	V REST	 T REST

DESCRIPTION

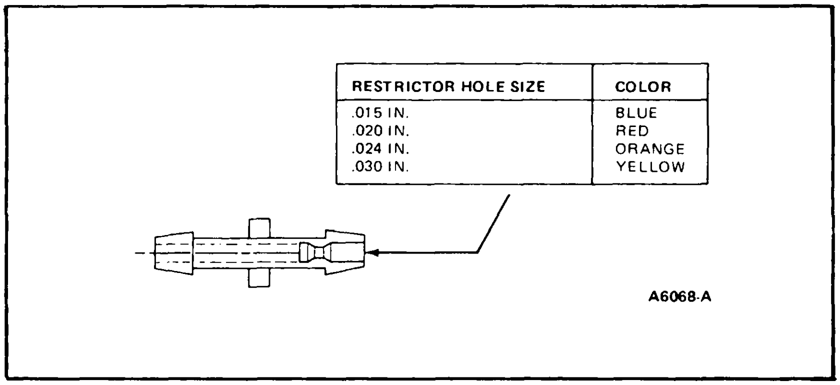
This orifice-type flow restrictor (Figure 1) is used in several emission calibrations to control the flow rate and/or timing inactions to the following emission component systems:

a. EGR valve timing—opening and closing.

b. Part throttle spark advance

c. Purge system

d. Thermactor system



RESTRICTOR HOLE SIZE	COLOR
.015 IN.	BLUE
.020 IN.	RED
.024 IN.	ORANGE
.030 IN.	YELLOW

Figure 1 Distributor Vacuum Restrictor

DIAGNOSIS

The flow rate through the restrictor is the same in both directions. If it is blocked, replace it.

TITLE	BASIC PART NO.	SYMBOL
Vacuum Vent Valve	**12A226**	 VACVV-D

DESCRIPTION

The Vacuum Vent Valve, (Figure 1) controls the induction of fresh air into a vacuum system to prevent chemical decay of the vacuum diaphragm that can occur on contact with fuel. The 12A226 (natural cap) is a combined vent and delay valve. Although this valve was intended for use in a specific system with an air cleaner mounting, it may be used in any other vacuum system and mounted elsewhere. The valve should be mounted, as shown, with ports pointing downward for fuel drainback. The vacuum source must be connected to the cap port and the system or device operated, to the body port, as shown.

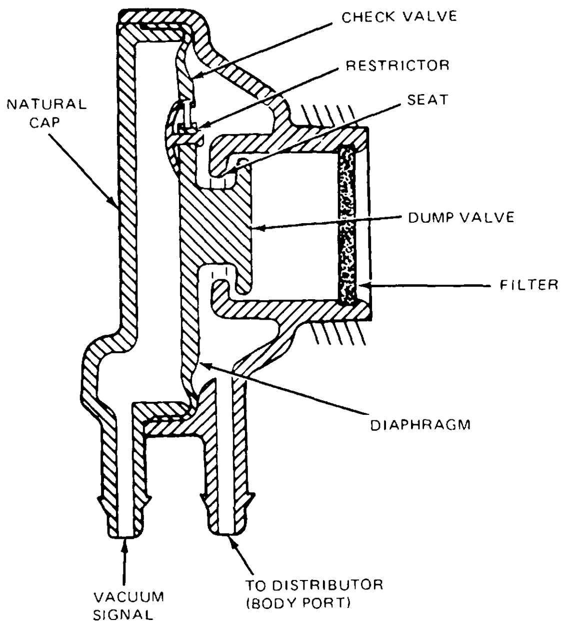


Figure 1 Vacuum Vent Valves — 12A226

DIAGNOSIS

1. With no vacuum applied to the signal port, the distributor (body port) should be open to atmosphere.
2. With an applied vacuum, the distributor should be closed to atmosphere.
3. A vacuum applied to the signal port and trapped should bleed off when the distributor port is open.

TITLE	BASIC PART NO.	SYMBOL
Vane Airflow Meter	**12B529**	

DESCRIPTION

The Vane Airflow Meter (Figure 1), measures air flowing into the engine and is mounted between the air cleaner and the air throttle body assembly. The meter contains a movable vane directly connected to an electrical device known as a potentiometer. Air, rushing through the van airflow meter, changes the position of the vane and the potentiometer. The potentiometer relays vane position information to the EEC-IV module. The EEC-IV module can then translate vane position information into the volume of air flowing into the engine.

Inside the vane airflow meter is an air temperature sensor. This sensor constantly monitors the temperature of the air flowing into the engine. This information is also transmitted to the EEC-IV module.

The EEC-IV module computes volumetric airflow and air temperature, then adjusts the fuel flow to obtain the optimum air/fuel mixture.

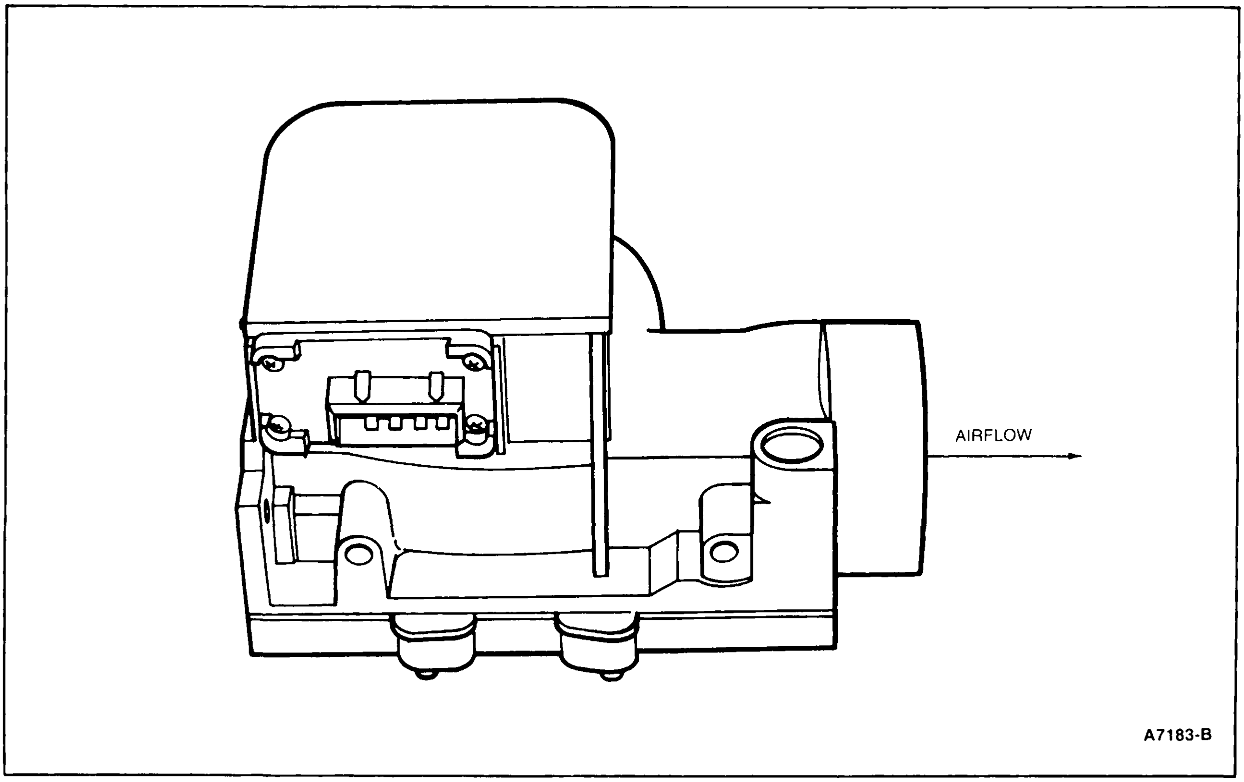


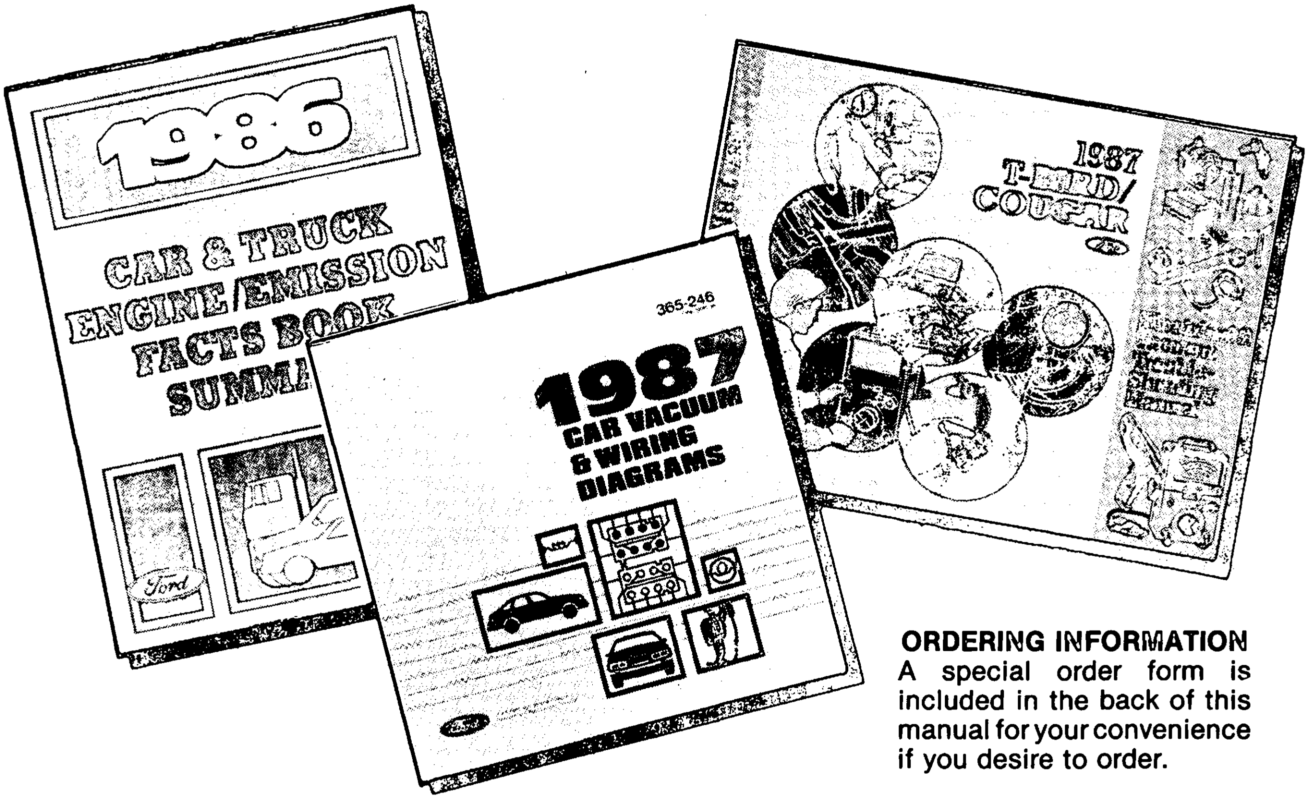
Figure 1 Vane Airflow Meter

DIAGNOSIS

Refer to the EEC-IV Quick Test, Section 16.

OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS



ORDERING INFORMATION
A special order form is included in the back of this manual for your convenience if you desire to order.

ENGINE EMISSIONS FACTS BOOK

- The manual contains complete specifications for each calibration number.
- Published at the conclusion of the model year.

ELECTRICAL & VACUUM TROUBLESHOOTING MANUAL (EVTM)

- Available for all passenger car and light truck vehicles, this publication provides schematics of all electrical and vacuum circuits. Wiring diagrams show how the circuit is powered. Troubleshooting hints are provided to point the technician in a general direction but are not step by step procedures.
- Available in the first quarter of the model year. (One manual for each passenger car and light truck family.)

WIRING & VACUUM DIAGRAMS

- This publication contains wiring diagrams for all Ford and Lincoln/Mercury passenger car and light truck vehicles. A Power Distribution system illustrates the power distribution throughout each vehicle. In addition, all individual electrical circuits are shown for each vehicle line.
- Available in the first quarter of the model year.

Service Specifications Manuals

(CAR AND TRUCK)

- These manuals contain all specifications including maintenance and lubrication contained in the Shop Manuals in a handy pocket size for easy reference.
- Available in the first quarter of the model year.

SECTION 4

Carburetors, Fuel Charging Assemblies and Throttle Bodies

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Idle Emission Testing

Canada and some states or metropolitan areas in the United States require periodic Idle Emission Tests. All Ford products have been certified to pass these tests.

If a Ford product fails an Idle Emission Test, it is probable that the vehicle has idled too long just prior to the test. Too long at idle will trigger the Thermactor Air System to dump Thermactor air into the atmosphere to prevent overheating of the exhaust system.

It is recommended that the following procedure be followed for testing idle emissions on Ford products:

Preceed any measurement of idle emissions by turning off ignition, restarting and operating engine at 2500, ± 300 rpm, for 30 seconds. Measure idle emissions within 30 seconds after returning to idle.

Complaints of Idle Emission Test failure should be verified by using the above procedure prior to starting any services.

CFI, EFI & Carburetor System Troubleshooting

SYMPTOM	SYSTEM	POSSIBLE SOURCE	ACTION
○ No Start — Cold	● Carburetor	● No fuel in carburetor bowl.	○ Check fuel bowl sight glass. Check by actuating accelerator pump. If no fuel discharge is seen, check fuel delivery system. Refer to Group 24 or Section 11.
		● Cold enrichment or choke system not functioning.	○ Check linkage for proper operation and adjustment; clean, service, or replace as required.
		● Venturi valve sticking open, **7200 only**.	○ Clean and service as required.
		● Clogged air bleeds or idle passages.	○ Clean with solvent and compressed air.
	● CFI-EFI	● Inoperative ISC motor.	○ Go to EEC-IV Diagnostics.
		● TP sensor stuck at WOT	○ Crank engine with TP sensor disconnected.
		● Plugged or inoperative injector.	○ Check for fuel injector discharge at the injector. (Use injector tester/ cleaner Rotunda 113-00001 EFI only). Go to EEC-IV Diagnostics.
			Return to Routine 201.

CA6011-F

CFI, EFI & Carburetor System Troubleshooting

SYMPTOM	SYSTEM	POSSIBLE SOURCE	ACTION
• Hard Start — Cold	• Carburetor	• Cold enrichment or choke system not functioning.	• Check linkage for proper operation and adjustment; clean, service or replace as required.
		• Incorrect choke housing adjustment, lean or rich.	• Adjust choke. If tamperproof, check for correct assembly.
		• Venturi valve sticking open, **7200 only.**	• Clean and service as required.
		• Hot idle compensator stuck open.	• Service as required. Refer to Section 3.
		• Restricted choke vacuum air passages.	• Remove carburetor and clean passages. Blow out with compressed air.
		• Accelerator pump not functioning, check visually for fuel discharge.	• Visually check for fuel discharge and service as required.
		• Leaking intake manifold or carburetor gaskets.	• Replace leaking gaskets.
		• Feedback motor inoperative, **7200 only**.	• Clean and service as required, per Section 3.
		• Faulty TCP Valve. Temperature Compensated (accelerator) Pump.	• Check function and service as required. Refer to Section 3.
	• CFI-EFI	• ISC inoperative	• Go to EEC-IV Diagnostics
			Return to Routine 203.

CA6012-G

CFI, EFI & Carburetor System Troubleshooting

SYMPTOM	SYSTEM	POSSIBLE SOURCE	ACTION
o Rough Idle — Cold	o Carburetor	o Cold enrichment or choke system not functioning.	o Check linkage for proper operation and adjustment; clean, service, or replace as required. Check choke pull down adjustment. Check voltage to choke cap.
		o Improper curb idle adjustment.	o Perform curb idle adjustments.
		o ISC motor inoperative.	o Check ISC motor. Refer to Section 14 (Aisan Carburetor)
		o Improper fast idle adjustments.	o Perform fast idle adjustments.
		o Venturi valve sticking open, **7200 only**.	o Clean and service as required.
		o Venturi valve diaphragm leaking, **7200 only**.	o Check and service as required.
		o Feedback motor inoperative, **7200 only**.	o Check and service as required. Refer to Section 3.
		o Hot idle compensator (HIC) stuck open, **7200 only**.	o Check and service as required. Refer to Section 3.
		o Metering rod bent, **7200 only**.	o Check and service as required. Refer to Group 24.
		o Air cleaner duct vacuum motor damaged open to cold air source always.	o Service or replace as required. Refer to Section 3.
		o Improper idle mixture.	o Perform propane check, adjust if out of specification.
	o CFI-EFI	o Injector leaking or inoperative.	o Check operation of injector. (Use injector tester/cleaner for Rotunda 113-00001 EFI only).
		o Injector O-ring seal leaking.	o Perform injector/regulator leakage check.
			Return to Routine 204.

CA6013-F

CFI, EFI & Carburetor System Troubleshooting

SYMPTOM	SYSTEM	POSSIBLE SOURCE	ACTION
• Stall, Stumble, Hesitation — Cold	• Carburetor	• Cold enrichment or choke system not functioning.	• Check linkage for proper operation and adjustment; clean, service or replace as required. Check choke pulldown. Check voltage to choke cap.
		• Accelerator pump not functioning, check visually for fuel discharge.	• Visually check for fuel discharge and service as required.
		• Low fuel pump delivery.	• Test fuel pump, service or replace as required. Refer to Group 24 or Section 11.
		• Feedback motor malfunction, **7200 only**.	• Check and service as required. Refer to Section 3.
		• Clogged fuel filter.	• Clean or replace as required. Find cause.
		• Power valve stuck closed.	• Replace power valve.
		• Improper or obstructed main jets.	• Check, clean, or replace as required. For 7200, replace carburetor.
		• Air cleaner duct vacuum motor damaged open to cold air source.	• Service or replace as required. Refer to Section 3.
		• Venturi Valve Diaphragm failure, **7200 only.**	• Replace diaphragm.
		• Faulty Temperature Compensated Pump (TCP) valve.	• Check function and service as required. Refer to Section 3.
	• CFI-EFI	• T.P. sensor failure.	• Go to EEC-IV Diagnostics.
			Return to Routine 202 or 207.

CA6014-H

SYMPTOM	SYSTEM	POSSIBLE SOURCE	ACTION
• No Start — Hot	• Carburetor	• No fuel in carburetor bowl.	• Check by actuating accelerator pump. If no fuel discharge is seen, check fuel delivery sytem. Refer to Group 24 or Section 11.
		• Cold enrichment or choke system not functioning.	• Check linkage for proper operation and adjustment; clean, service, or replace as required.
		• Venturi valve sticking, **7200 only**.	• Clean and service as required.
		• Flooding or loading.	• Check float level, adjust as required.
	• CFI-EFI	• Inoperative ISC motor.	• Go to EEC-IV Diagnostics.
		• TP sensor stuck at WOT.	• Go to EEC-IV Diagnostics.
		• Injector inoperative.	• Check for fuel discharge while cranking engine. (Use injector tester/cleaner Rotunda 113-00001 EFI only).
			Return to Routine 201.

CA6015-G

CFI, EFI & Carburetor System Troubleshooting

SYMPTOM	SYSTEM	POSSIBLE SOURCE	ACTION
o Hard Start, Hot	o Carburetor	o Cold enrichment or choke system not functioning.	o Check linkage for proper operation and adjustment; clean, service, or replace as required.
		o Incorrect thermostat housing adjustment, lean or rich.	o Adjust thermostat housing and choke cap. If tamperproof, check for correct assembly.
		o Venturi valve sticking open, **7200 only**.	o Clean and service as required.
		o Bowl vents plugged.	o Check internal vent for adjustment and external vent for kinked hose.
		o Feedback motor inoperative, **7200 only**.	o Check and service as required. Refer to Section 3.
		o Flooding or loading.	o Check float level, service as required.
		o Restricted choke vacuum or hot air passages.	o Remove carburetor and clean choke passages and blow out with air.
		o Leaking intake manifold or carburetor gaskets.	o Replace leaking gaskets.
		o ISC motor inoperative.	o Check ISC motor. Refer to Section 14 (Aisan Carburetor).
	o CFI-EFI	o Excessive fuel pressure.	o Clean and service — — Fuel return line. — Fuel pressure regulator.
		o Contaminated fuel pressure regulator valve and seat.	o Clean and service fuel pressure regulator. o Check fuel pressure bleed down after engine has been turned off.
		o Injector leaking or inoperative.	o Check operation of injector. Use injector tester/cleaner Rotunda 113-00001 (for EFI only).
		o Injector O-ring seal leaking.	o Perform injector leakage test.
		o ISC inoperative	o Go to EEC-IV Diagnostics
			Return to Routine 203.

CA6016-F

CFI, EFI & Carburetor System Troubleshooting

SYMPTOM	SYSTEM	POSSIBLE SOURCE	ACTION
• Rough Idle — Hot	• Carburetor	• Cold enrichment or choke system not functioning.	• Check linkage for proper operation and adjustment; clean, service, or replace as required.
		• Venturi valve sticking, **7200 only**.	• Clean and service as required.
		• Improper idle adjustments.	• Perform all idle adjustments.
		• Throttle plates sticking.	• Check and service as required.
		• Choke pulldown diaphragm not functioning.	• Check and service as required.
		• Venturi valve diaphragm leaking, **7200 only**.	• Check and service as required.
		• Hot idle compensator stuck closed or open.	• Service or replace as required. Refer to Section 3.
		• Improper idle mixture.	• Perform propane check, adjust if out of specification.
		• Clogged air bleeds or air passages.	• Clean with solvent and compressed air.
		• Improper fuel level.	• Adjust float level.
		• Feedback motor, **7200 only**.	• Check for smooth operation. Refer to Section 3.
		• Temperature Compensated Accelerator Pump Diaphragm not functioning.	• Check function and service as required. Refer to Section 3.
		• ISC motor inoperative.	• Check ISC motor. Refer to Section 14 (Aisan Carburetor).
	• CFI-EFI	• Injector leaking or inoperative.	• Check operation of injector. Use injector tester/cleaner Rotunda 113-00001 (EFI only).
		• Injector O-ring seal leaking.	• Perform injector leakage test.
			Return to Routine 204.

CA6017-G

CFI, EFI & Carburetor System Troubleshooting

SYMPTOM	SYSTEM	POSSIBLE SOURCE	ACTION
o Stall, Stumble, Hesitation — Hot	o Carburetor	o Cold enrichment or choke system not functioning.	o Check linkage for proper operation and adjustment; clean, service, or replace as required.
		o Inoperative accelerator pump.	o Visually check for pump shot or fuel siphoning. Service as required. Refer to Section 3.
		o Low fuel pump volume.	o Test pump; fuel delivery system. Refer to Group 24 or Section 11.
		o Feedback motor malfunctioning, **7200 only**.	o Check and service as required. Refer to Section 3.
		o Bowl vents plugged.	o Check internal vent adjustments, external for kinked hoses.
		o Clogged fuel filter.	o Check and replace as required. Check cause.
		o Power valve stuck closed.	o Replace valve.
		o Improper or obstructed main jets.	o Check, clean or replace as required. **For 7200, replace carburetor**.
		o Venturi Valve Diaphragm failure, **7200 only.**	o Replace diaphragm.
		o Temperature Compensated Accelerator Pump Malfunction.	o Check function and service as required. Refer to Section 3.
		o Carburetor Feedback System Malfunction.	o Refer to appropriate MCU or EEC Diagnostic procedure.
			Return to Routine 202 or 207.

CA6018-H

SYMPTOM	SYSTEM	POSSIBLE SOURCE	ACTION
o Stalls on Decel or Quick Stop	o Carburetor	o Idle speed low.	o Check and adjust as required.
		o Throttle positioner not functioning.	o Check and service as required.
		o Venturi valve sticking, **7200 only.**	o Check and service as required.
		o Feedback motor malfunctioning, **7200 only**.	o Check and service as required. Refer to Section 3.
		o Clogged air bleeds or idle passages.	o Remove and clean with solvent and compressed air.
		o Venturi Valve diaphragm leaks, **7200 only.**	o Replace diaphragm.
		o Leaking intake manifold or carburetor gaskets.	o Replace leaking gaskets.
		o Dashpot failure.	o Replace dashpot.
		o ISC motor inoperative.	o Check ISC motor. Refer to Section 14 (Aisan Carburetor).
	o CFI-EFI	o ISC inoperative.	o Go to EEC-IV Diagnostics.
			Return to Routine 206.

CA6019-G

CFI, EFI & Carburetor System Troubleshooting

SYMPTOM	SYSTEM	POSSIBLE SOURCE	ACTION
• Lack of Power	• Carburetor	• Sticking venturi valve or leaking diaphragm, **7200 only**.	• Check, clean and service as required.
		• Venturi valve limiter out of adjustment, **7200 only**.	• Adjust as required.
		• Accelerator pump not functioning or improper adjustment. Check visually for fuel discharge.	• Check and service as required.
		• Control vacuum regulator off specification (high), **7200 only.**	• Check and adjust as required.
		• Plugged pump discharge nozzle.	• Clean nozzle with compressed air.
		• Leaking fuel at pump discharge nozzle screw gasket.	• Replace gasket.
		• Improper float setting.	• Adjust float level.
		• Main metering system plugged, contaminated fuel.	• Clean fuel system as required.
		• Venturi Valve Diaphragm failure, **7200 only.**	• Replace diaphragm.
		• Feedback motor, **7200 only**.	• Check for smooth operation. Refer to Section 3.
		• Fuel filter or fuel delivery lines restricted.	• Check fuel delivery. Refer to Group 24 or Section 11.
		• Temperature Compensated Accelerator Pump Malfunction.	• Check function and service as required. Refer to Section 3.
		• Carburetor feedback system malfunction.	• Refer to appropriate MCU or EEC Diagnostic procedure.
		• Secondary throttle plates stuck closed.	• Check and service as required. Refer to Group 24.
			Return to Routine 209.

CA6020-H

SYMPTOM	SYSTEM	POSSIBLE SOURCE	ACTION
• Poor Mileage, But Drives alright.	• Carburetor	• Feedback motor malfunction, **7200 only**.	• Check and service as required. Refer to Section 3.
		• Carburetor feedback system malfunction.	• Refer to appropriate MCU or EEC Diagnostic Procedure.
		• Cold enrichment, or choke system malfunctioning.	• Check choke system function and adjustment.
		• Purge vent control valve malfunctioning.	• Check evaporative control valve and evaporative system. Refer to Section 7.
	• CFI-EFI	• Injector O-ring seal leaking	• Perform injector leakage test.
			Return to Routines 213, 219

CA6338-E

CFI, EFI & Carburetor System Troubleshooting

SYMPTOM	SYSTEM	POSSIBLE SOURCE	ACTION
● Reduced Top Speed/Power	● Carburetor	○ Venturi valve sticking, **7200 only**.	● Check, clean and service as required.
		○ Incorrect venturi WOT opening, **7200 only**.	● Adjust as required.
		○ Binding throttle linkage.	● Clean and service as required.
		○ Venturi valve diaphragm leaking, **7200 only**.	● Check and service as required.
		○ Low fuel pump volume.	● Test fuel delivery system. Refer to Group 24, or Section 11.
		○ Metering rods bent, **7200 only**.	● Service as required.
		○ Incorrect float drop.	● Adjust as required.
		○ Clogged fuel filter.	● Replace as required. Check cause.
		○ Power valve stuck closed.	● Replace power valve.
		○ Improper or obstructed main jets.	● Clean or replace as required. **For 7200, replace carburetor.**
		○ Inoperative secondary system on two-staged carburetors.	● Check shaft and plate alignment, binding linkage, service as required.
		○ Feedback motor inoperative.	● Check for smooth operation. Refer to Section 3.
		○ Carburetor feedback system malfunction.	● Refer to appropriate MCU or EEC Diagnostic procedure.
	● CFI-EFI	○ Plugged injectors.	● Check for fuel injector discharge at injector. (Use injector tester/cleaner Rotunda 113-00001 EFI only).
		○ Damaged fuel pressure regulator.	● Refer to Group 24 or Section 11.
			Return to Routine 209.

CA6021-F

CFI, EFI & Carburetor System Troubleshooting

SYMPTOM	SYSTEM	POSSIBLE SOURCE	ACTION
• Surge at Cruise	• Carburetor	• Restricted fuel delivery or fuel filter.	• Replace filter. Refer to Section 11.
		• Improper fuel level.	• Adjust float level and drop, check float hinge pin for binding; service and adjust as required.
		• Low fuel pump volume or pressure.	• Test fuel delivery system. Refer to Group 24 or Section 11.
		• Contaminated fuel.	• Drain fuel, clean as required.
		• Damaged metering rods, **7200 only**.	• Replace.
		• Feedback motor inoperative.	• Check for smooth operation. Refer to Section 3.
		• Blocked air bleeds.	• Clean and service as required.
		• Fuel leaks around carburetor.	• Service as required.
	• CFI-EFI	• Plugged or leaking fuel injectors	• Check injector operation. Use Injector Tester/Cleaner Rotunda 113-00001 (EFI only).
			Return to Routine 210.

CA6022-F

SYMPTOM	SYSTEM	POSSIBLE SOURCE	ACTION
• Flooding	• Carburetor	• Float problem.	• Service as required.
		• Damaged fuel inlet or sticking needle.	• Service as required.
		• Excessive fuel pressure.	• Check fuel pressure. • Service fuel return line
	• CFI-EFI	• Excessive fuel pressure.	• Service fuel pressure regulator.
		• Injector stuck open, or O-ring seal leaking.	• Check injector operation. (Use injector tester/cleaner Rotunda 113-00001 EFI only). • Perform leakage check.

CA6023-E

SYMPTOM	SYSTEM	POSSIBLE SOURCE	ACTION
• Engine Diesels or Idles too Fast	• Carburetor	• Not coming off fast idle cam.	• Check linkage for proper operation and adjustment; clean, service, or replace as required.
	• Carburetor CFI-EFI	• Incorrect idle speed adjustment.	• Perform all idle adjustments.
		• Vacuum leaks.	• Check all vacuum lines and connections.
		• ISC motor inoperative.	• Check ISC motor. Refer to Section 14 (Aisan Carburetor).
		• Sticking throttle plate or linkage.	• Visual check for proper operation.
			Return to Routine 211.

CA6024-E

Idle Speed Setting Procedures

PASSENGER CAR — 50 STATES

1.9L Engines w/CFI and DC Motor Idle Speed Control (ISC)

A quick check to verify that the ISC motor is operating properly. Start engine and run for at least 30 seconds and turn ignition key to the Off position and visually inspect ISC Motor retracting and repositioning.

WARNING: IF FOR ANY REASON THE BATTERY IS DISCONNECTED OR THE VEHICLE HAS TO BE JUMP STARTED THIS PROCEDURE MAY NEED TO BE PERFORMED.

Curb Idle Speed Check:

1. Set parking brake and block wheels. Make all checks/adjustments with engine at normal operating temperature and accessories Off. Only the TACH is needed for the procedure below. Before all checks, check for vacuum leaks.
2. After transmission is engaged in Drive for ATX and Neutral fro MTX, and the engine is idled for 120 seconds, idle rpm should be within specification (refer to decal for speeds). Place transmission in Neutral or Park, engine rpm should increase by approximately 75 rpm.
3. Lightly step on and off the accelerator. The engine rpm should return to decal specification. If the rpm remains high, wait 120 seconds and repeat the sequence. Remember it may take the system 120 seconds to "learn".

NOTE: Curb and fast idle speeds are controlled by the EEC-IV processor and the idle speed control device. If the control system is operating properly, these speeds are fixed and cannot be changed by traditional adjustment techniques.

Adjustments are sometimes required to establish the correct operating limit which the ISC system can properly function. This adjustment, as outlined below, will normally have no direct effect on actual idle speed and generally will not be required unless:

Curb idle speed is higher than specification as shown on the decal. Misadjustment of the operating limit could restrict the operating range of the ISC system, so adjustment of this limit should never be made unless a specific casual factor exists. If the operating limit adjustment does not correct an out of specification curb idle speed condition, it will be necessary to perform the appropriate 1.9L EEC-IV diagnostics.

Idle Speed Setting Procedures

Minimum ISC Limit Adjustment

If the curb idle is above specification, verify that the throttle linkage is free, that travel is unobstructed and that cruise control (if equipped) is not holding the throttle open. **If while the engine is running it is observed that the throttle lever is not in contact with the ISC motor, but held open by the throttle stop adjusting screw (TSAS), this screw must be adjusted.** Before proceeding any further verify that there are no vacuum leaks. This is the only reason for adjusting the TSAS as it is strictly a throttle stop and in no way affects idle speeds unless it is holding the throttle open through misadjustment. To adjust the TSAS, the ISC motor must be fully retracted. Therefore, the following TSAS adjustment procedure must be done in the exact sequence shown below:

1. Shut the engine off and remove the air cleaner. In the engine compartment, find the self-test connector and self-test input (STI) connector.
2. Connect a jumper wire between the self-test input (STI) connector and the signal return pin on the self-test connector as shown in Figure 1.

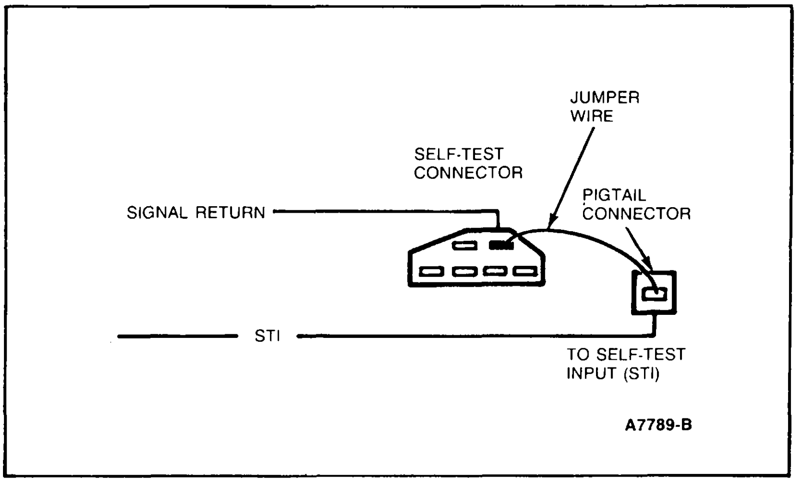


Figure 1 1.9L CFI Engines

3. Turn the ignition key to the Run position. Do Not Start Engine.
4. The ISC plunger will retract. Wait until plunger is fully retracted (about 10 to 15 seconds).

   NOTE: If plunger does not retract, refer to EEC-IV diagnostics.
5. Shut off the key, wait 10 to 15 seconds.
6. Remove the jumper wire.
7. Unplug the ISC motor from the harness (Figure 2).

Idle Speed Setting Procedures

8. Start engine and let it stabilize.
9. Check/adjust engine rpm by turning the throttle stop adjusting screw to 600 ± 50 rpm (Figure 2).
10. Shut engine off.
11. Reconnect the ISC motor harness (Figure 2).

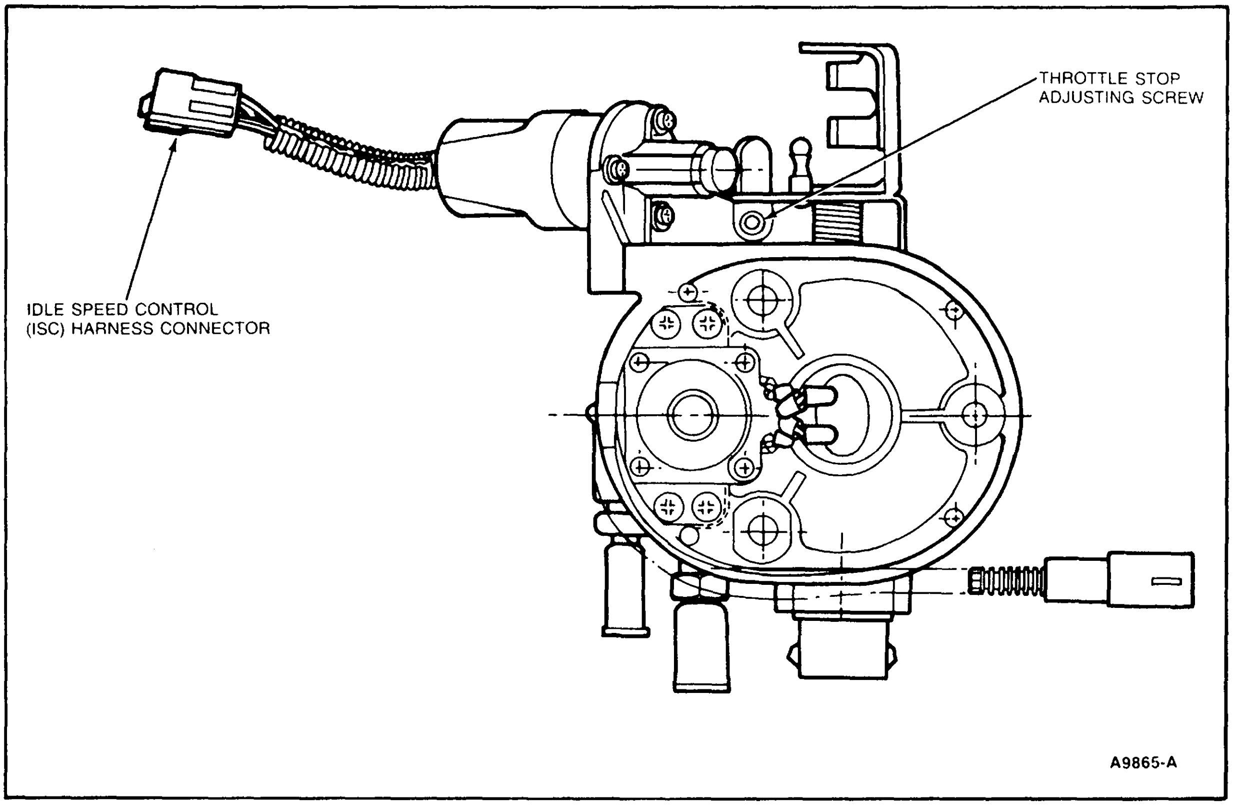


Figure 2 1.9L CFI Engines

Idle Speed Setting Procedures

PASSENGER CAR

1.9L Engine w/Port Electronic Fuel Injection (EFI)— Initial Engine RPM Adjustment Idle Speed Control-Bypass Air (ISC-BPA Disconnected)

NOTE: CURB idle RPM is controlled by the EEC-IV processor and the Idle Speed Control (ISC-BPA) device (part of the fuel charging assembly).

The purpose of this procedure is to provide a means of verifying the base idle engine RPM setting with the ISC-BPA disconnected and checking CURB idle RPM with ISC connected.

If base idle RPM is not within specification (see decal for specifications) after performing this procedure, it will be necessary to perform the appropriate 1.9L EFI EEC-IV diagnostics.

1. Place the transmission in NEUTRAL. Apply parking brake and block wheels.
2. Bring the engine to normal operating temperature and shut off.
3. Disconnect vacuum connector at EGR solenoid and plug both lines.
4. Disconnect idle speed control Bypass Air Solenoid (ISC-BPA) power lead.
5. Verify throttle plate is not stuck in the bore or the linkage is not preventing the throttle plate from closing.
6. Start engine and operate at 2000 RPM for 60 seconds.
7. Check/adjust base engine RPM within 120 seconds by adjusting throttle plate stop screw. See decal for specifications. Cooling fan must be off.
8. If idle adjustment is not completed within 120 second time limit, shut engine Off, restart and repeat Steps 6 and 7.

Idle Speed Setting Procedures

9. Turn engine Off and remove plugs from EGR vacuum lines at EGR solenoid and reconnect.
10. Reconnect idle speed control Bypass Air Solenoid ISC-BPA power lead.

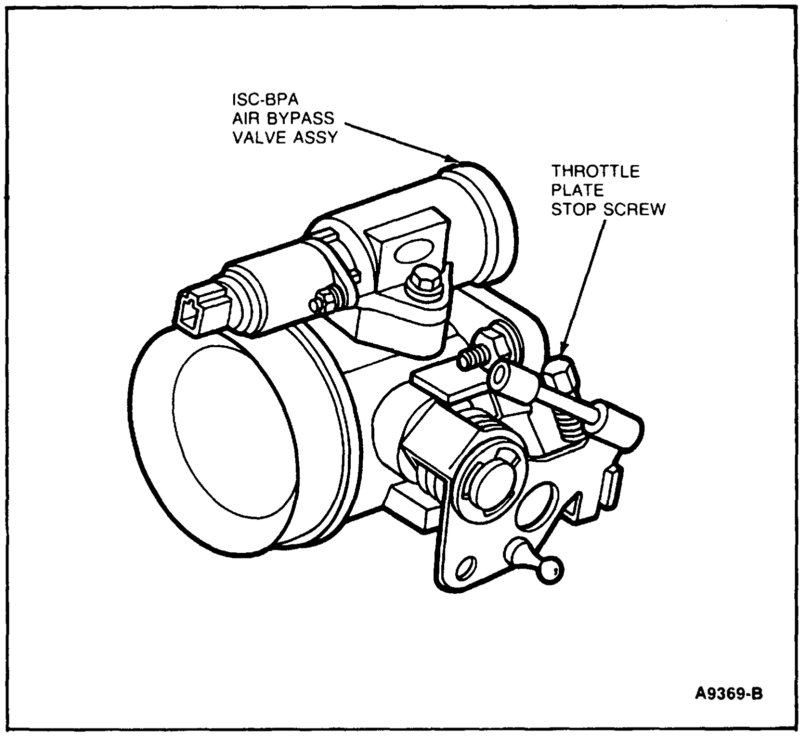


Figure 1 1.9L Engine w/Port Electronic Fuel Injection—Air intake Charge Throttle Body Assembly

11. Start engine and operate at 2000 RPM for 60 seconds.
12. Check the CURB idle RPM within 120 seconds (1000 ± 75 RPM).
13. If CURB idle check is not completed within the 120 seconds, shut engine Off, restart and repeat Steps 11 and 12.
14. If CURB idle RPM is not within specification, go to Quick Test (Section 16).

Idle Speed Setting Procedures

PASSENGER CAR AND TRUCK, UNDER 8500 GVW

2.3L OHC EFI

Instructions

This procedure is to be performed only if the curb idle is not within the Decal specification, with A/C off.

NOTE: Curb idle speed (rpm) is controlled by the EEC-IV processor and the idle speed control air bypass valve assembly (Figure 1). If engine curb idle rpm is not within specification after performing this procedure, it will be necessary to perform the appropriate 2.3L EFI EEC-IV diagnostics.

1. Place the transmission in Neutral, apply parking brake and turn the A/C-Heat selector to the Off position.
2. Bring the engine to normal operating temperature and turn Off.
3. Disconnect the idle speed control air bypass valve power lead (Figure 1).
4. Start engine and operate at 1500 rpm for 20 seconds.
5. Let engine idle and check base idle speed (525 ± 25 rpm passenger car, 575 ± 25 rpm truck).

   NOTE: Engine may stall when ISC-BPA is diconnected. This is acceptable as long as the throttle plate is not stuck in the bore.
6. Adjust as follows:
   - Disconnect throttle cable.
   - Adjust engine rpm to within range in Step 5 by turning the throttle plate stop screw.
   - Reconnect throttle cable and repeat Step 5.
7. Shut engine off and reconnect power lead to idle speed control air bypass valve.
8. Verify throttle plate is not stuck in the bore by exercising throttle plate.

   NOTE: If excessive engine idle speeds are experienced when driving the vehicle on the idle system, turn the ignition switch to Off position and restart.

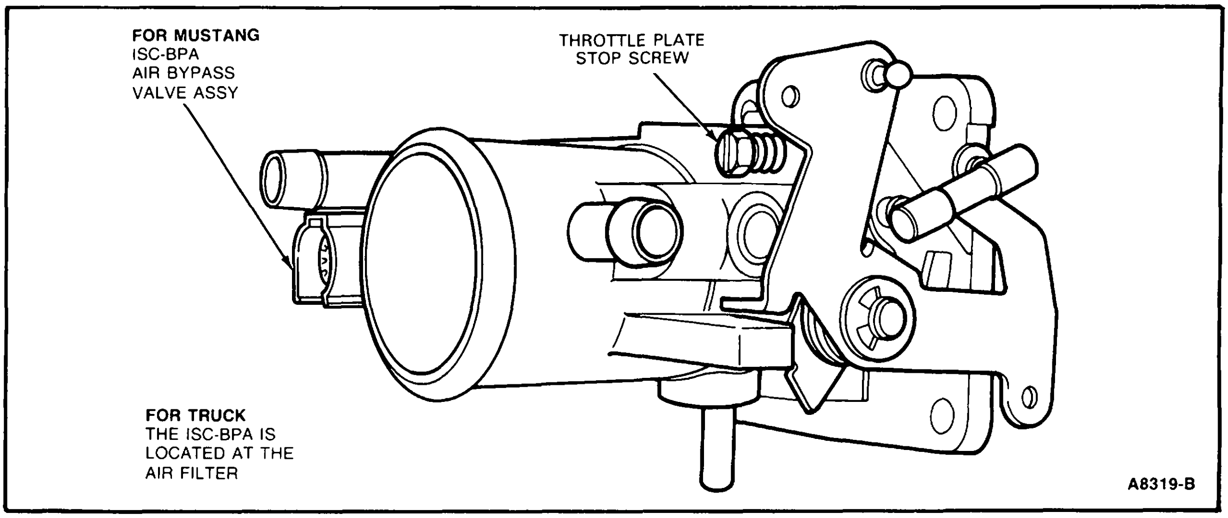


Figure 1 2.3L OHC EFI Engine

Idle Speed Setting Procedures

PASSENGER CAR

2.3L EFI Turbo

Instructions

This procedure is to be performed only if the curb idle is not within the 900 ± 75 rpm specification.

NOTE: Curb idle speed (RPM) is controleed by the EEC-IV processor and the idle speed control air bypass (ISC-BPA) valve assembly (Figure 1). If engine curb idle rpm is not within specification after performing this procedure, it will be necessary to perform the appropriate 2.3L EFI Turbo EEC-IV diagnostics.

1. Place the transmission in Neutral, apply parking brake and turn the A/C-Heat selector to the Off position.
2. Bring the engine to normal operating temperature and turn Off.
3. Disconnect the idle speed control air bypass valve power lead.
4. Start engine and operate at 2,000 rpm for 120 seconds.
5. If electric fan comes on during idle speed set procedure, wait for the fan to turn off before proceeding or disconnect it.
6. Let engine idle and check base idle rpm (750 ± 50 rpm).
7. Adjust engine rpm to specification (Step 6) by adjusting throttle plate stop screw (Figure 1).
8. Shut engine off and reconnect.
   - o Power lead to idle speed control air bypass valve.
   - o Electric cooling fan.
9. Verify throttle plate is not stuck in the bore by exercising throttle plate.

NOTE: If excessive engine idle speeds are experienced when driving the vehicle on the idle system, tum the ignition switch to Off position and restart.

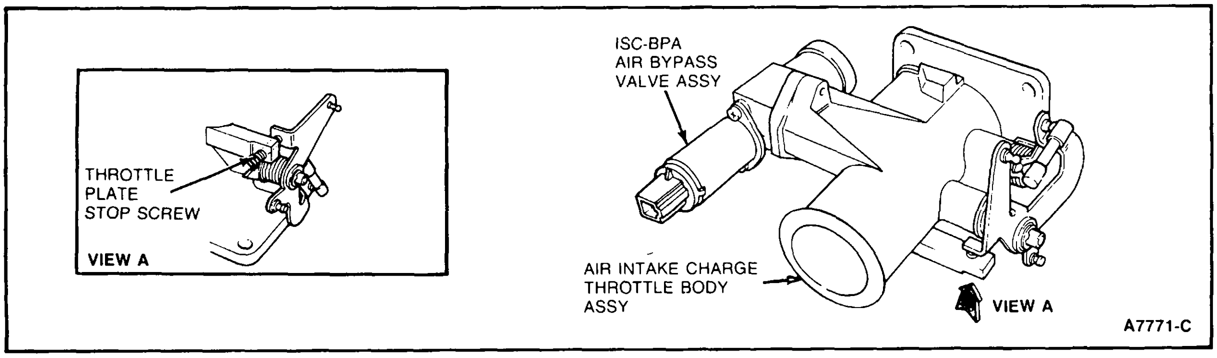

THROTTLE PLATE STOP SCREW
VIEW A
ISC-BPA AIR BYPASS VALVE ASSY
AIR INTAKE CHARGE THROTTLE BODY ASSY
VIEW A
A7771-C

Figure 1 2.3L Turbo w/Electronic Fuel Injection

Idle Speed Setting Procedures

PASSENGER CAR — CANADA

2.3L HSC Engine w/1949 — Fast Idle RPM

Instructions

1. Place transaxle in Neutral or Park (Parking Brake on).
2. Bring engine to normal operating temperature running on second step of fast idle cam (Figure 1).
3. Return throttle to normal idle position.
4. Place A/C selector in the Off position.
5. Disconnect vacuum hose at the EGR valve and plug.
6. Place the fast idle rpm adjusting screw on the specified step of the fast idle cam (Figure 1).
7. Check/adjust fast idle rpm to specification.
8. Rev the engine momentarily, allowing engine to return to idle and turn ignition key to Off position.
9. Remove plug from the EGR vacuum hose and reconnect.

Idle Speed Setting Procedures

PASSENGER CAR — CANADA

2.3L HSC Engine w/1949 — Curb Idle RPM

Instructions

NOTE: A/C—On RPM is non-adjustable. TSP-Off RPM is not required. Verify that TSP plunger extends with ignition key On.

1. Place transaxle in Neutral or Park (parking brake On).
2. Disconnect throttle kicker vacuum line and plug.
3. Bring engine to normal operating temperature. (Cooling fan should cycle).
4. Place A/C selector in the Off position.
5. Place transaxle in specified position.
6. Activate cooling fan by grounding control wire with jumper.
7. Check/adjust curb idle rpm with automatic transmission in Drive, manual transmission in Neutral. If adjustment is required, turn curb idle rpm adjusting screw (Figure 2).
8. Place the transaxle in Neutral or Park. Rev the engine momentarily. Place transaxle in specified position and recheck curb idle rpm. Readjust if required.
9. Remove ground wire jumper from cooling fan wiring.
10. Turn the ignition key to the Off position.
11. Reconnect vacuum line to throttle kicker.
12. If vehicle is equipped with an automatic transaxle and curb idle adjustment exceeds 50 rpm, refer to automatic transaxle linkage adjustment procedure, Powertrain Shop Manual, Section 17-01.
13. Remove all test equipment and reinstall air cleaner assembly. Tighten hold-down bolt to specification.

Idle Speed Setting Procedures

PASSENGER CAR — CANADA

2.3L HSC Engine w/1949 — TSP Off RPM

Instructions

NOTE: This adjustment is not required as part of a normal engine idle RPM check/adjustment. It should only be performed on a customer complaint if engine continues to run after ignition key is turned to Off position.

1. Place transaxle in Neutral or Park (parking brake On).
2. Bring engine to normal operating temperature.
3. Disconnect throttle kicker vacuum line and plug.
4. Place A/C selector to Off position.
5. Disconnect the electrical lead to the TSP and verify that plunger collapses (Figure 3). Check/adjust engine RPM to specification (600 rpm).
6. Adjust TSP Off RPM to specification (Figure 3).
7. Shut engine off, reconnect TSP electrical lead and throttle kicker vacuum line.

Idle Speed Setting Procedures

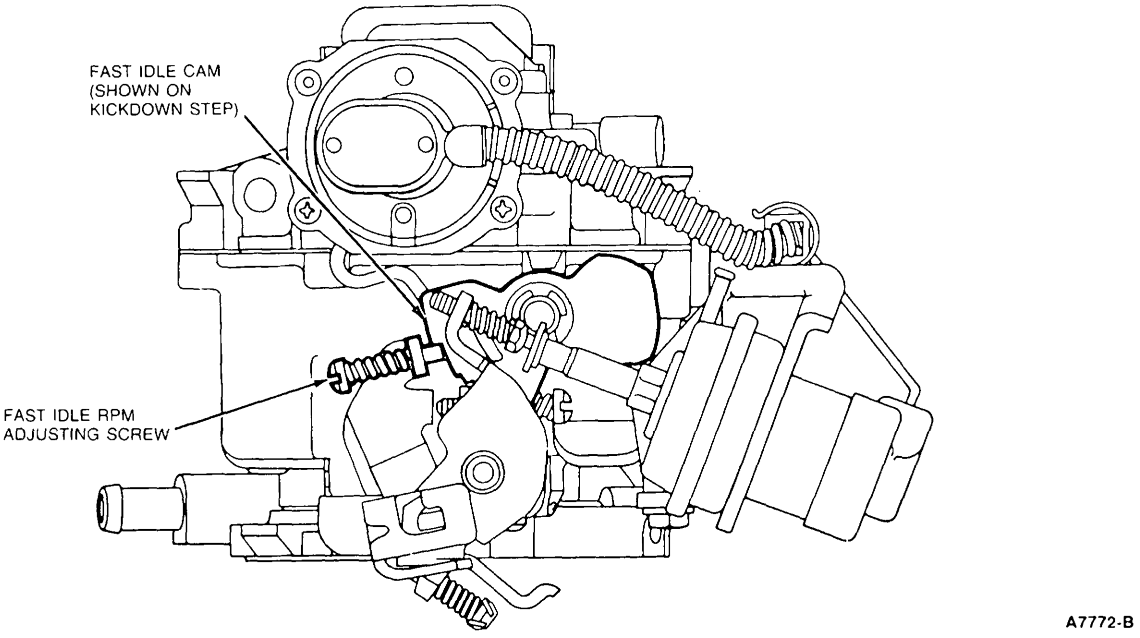


Figure 1 2.3L HSC w/1949 — Fast Idle RPM

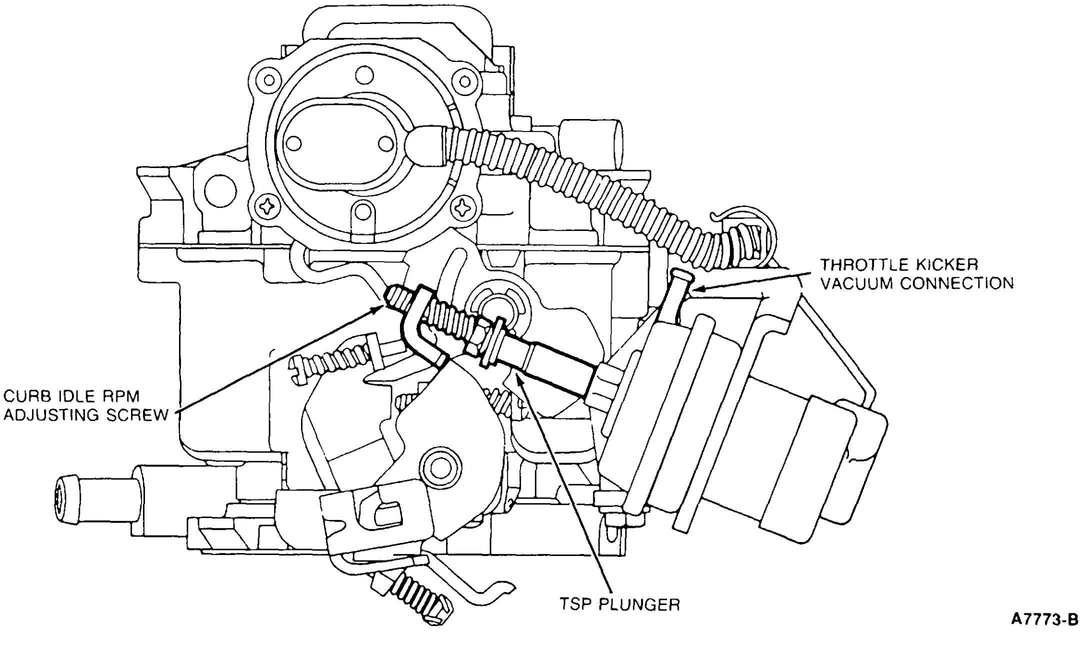


Figure 2 2.3L HSC w/1949 — Curb Idle RPM

Idle Speed Setting Procedures

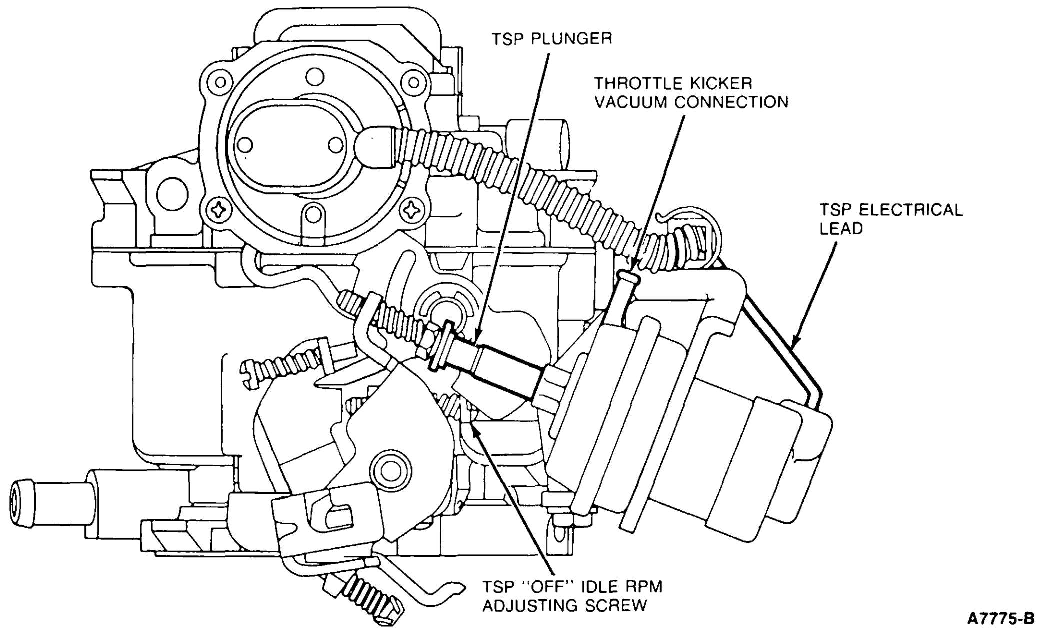

TSP PLUNGER
THROTTLE KICKER VACUUM CONNECTION
TSP ELECTRICAL LEAD
TSP "OFF" IDLE RPM ADJUSTING SCREW
A7775-B

Figure 3 2.3L HSC w/1949 — TSP Off Idle RPM

Idle Speed Setting Procedures

PASSENGER CAR — 50 STATES

2.3L & 2.5L HSC Engines w/CFI and DC Motor Idle Speed Control (ISC)

A quick check to verify that the ISC motor is operating properly. Start engine and run for at least 30 seconds and turn ignition key to the Off position and visually inspect ISC Motor retracting and repositioning.

WARNING: IF FOR ANY REASON THE BATTERY IS DISCONNECTED OR THE VEHICLE HAS TO BE JUMP STARTED THIS PROCEDURE MAY NEED TO BE PERFORMED.

Curb Idle Speed Check:

1. Set parking brake and block wheels. If equipped with automatic brake release, disconnect the vacuum hose and then plug it, when checking curb idle. Make all checks/adjustments with engine at normal operating temperature and accessories Off. Only the TACH is needed for the procedure below. Before all checks, check for vacuum leaks.
2. After transmission is engaged in Drive for ATX and Neutral for MTX, and the engine is idled for 120 seconds, idle rpm should be within specification (refer to decal for speeds). Place transmission in Neutral or Park, engine rpm should increase by approximately 100 rpm.
3. Lightly step on and off the accelerator. The engine rpm should return to decal specification. If the rpm remains high, repeat the sequence. Remember it may take the system 120 seconds to "learn".

NOTE: Curb and fast idle speeds are controlled by the EEC-IV processor and the idle speed control device. If the control system is operating properly, these speeds are fixed and cannot be changed by traditional adjustment techniques.

Adjustments are sometimes required to establish the correct operating limit which the ISC system can properly function. This adjustment, as outlined below, will normally have no direct effect on actual idle speed and generally will not be required unless:

Curb idle speed is higher than specification as shown on the decal. Misadjustment of the operating limit could restrict the operating range of the ISC system, so adjustment of this limit should never be made unless a specific causal factor exists. If the operating limit adjustment does not correct an out of specification curb idle speed condition, it will be necessary to perform the appropriate 2.3L & 2.5L EEC-IV diagnostics.

Idle Speed Setting Procedures

Minimum ISC Limit Adjustment

If the curb idle is above specification, verify that the throttle linkage and the throttle plate are free, that travel is unobstructed and that cruise control (if equipped) is not holding the throttle open. **If while the engine is running it is observed that the throttle lever is not in contact with the ISC motor, but held open by the throttle stop adjusting screw (TSAS), this screw must be adjusted.** Before proceeding any further verify that there are no vacuum leaks. This is the only reason for adjusting the TSAS as it is strictly a throttle stop and in no way affects idle speeds unless it is holding the throttle open through misadjustment. To adjust the TSAS, the ISC motor must be fully retracted. Therefore, the following TSAS adjustment procedure must be done in the exact sequence shown below:

1. Shut the engine off and remove the air cleaner. In the engine compartment, find the self-test connector and self-test input (STI) connector.
2. Connect a jumper wire between the self-test input (STI) connector and the signal return pin on the self-test connector as shown in Figure 1.

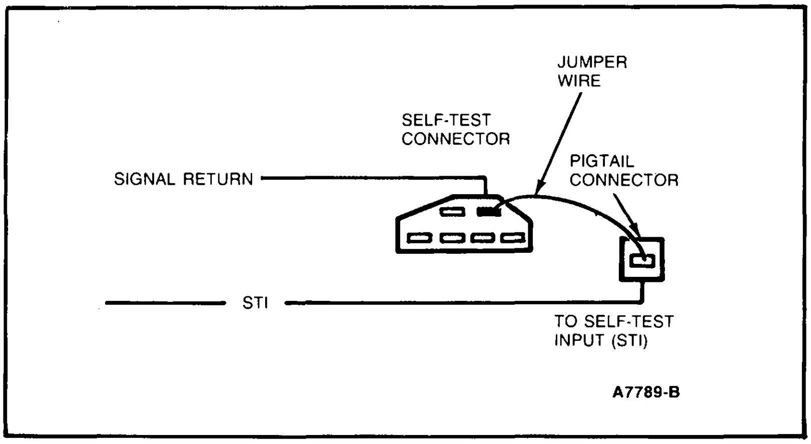


Figure 1 2.3L and 2.5L HSC CFI Engines

Idle Speed Setting Procedures

3. Turn the ignition key to the run position. Do Not Start Engine.
4. The ISC plunger will retract. Wait until plunger is fully retracted (about 10 to 15 seconds).

   NOTE: If plunger does not retract, refer to EEC-IV diagnostics.
5. Shut off the key, wait 10 to 15 seconds.
6. Remove the jumper wire.
7. Unplug the ISC motor from the harness (Figure 2).
8. Perform throttle stop adjustments as follows:
   - Remove CFI assembly from vehicle.
   - Use an ice pick or small punch to remove the aluminum plug which covers the throttle stop adjusting screw (Figure 2).
   - Remove and replace the screw.
9. Reinstall CFI assembly on vehicle, stabilize engine and set the idle 100 rpm (MTX) and 50 rpm (ATX) less than the decal specification on throttle stop adjusting screw.
10. Reconnect the ISC motor harness (Figure 2).

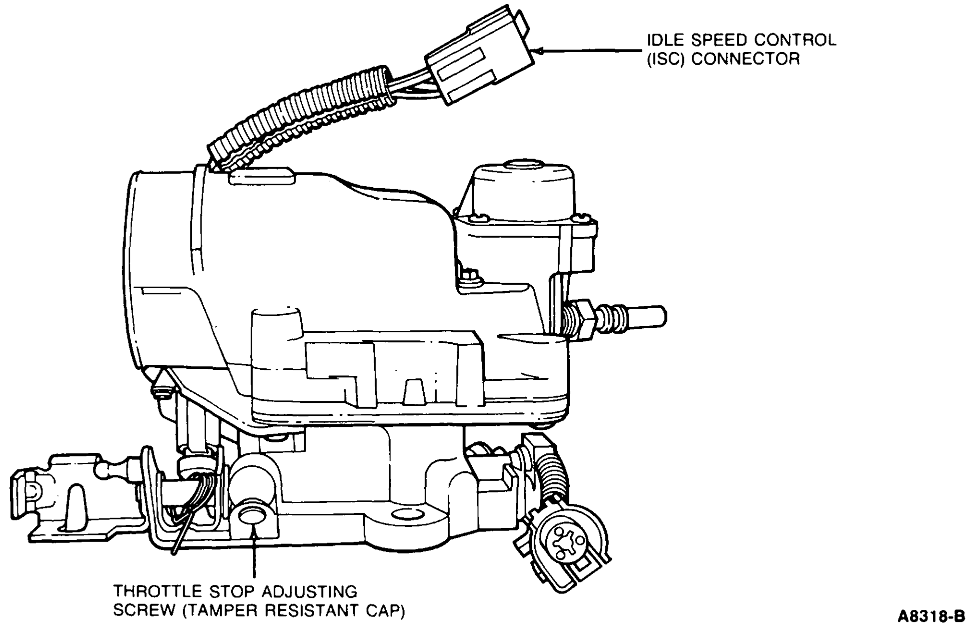

IDLE SPEED CONTROL (ISC) CONNECTOR
THROTTLE STOP ADJUSTING SCREW (TAMPER RESISTANT CAP)
A8318-B

Figure 2 2.3L and 2.5L HSC CFI Engines

Idle Speed Setting Procedures

PASSENGER CAR AND TRUCK UNDER 8500 GVW

3.0L EFI

NOTE: Curb idle speed (rpm) is controlled by the EEC-IV processor and the idle speed control air bypass valve assembly (ISC-BPA). The throttle plate stop screw is factory set and does not directly control idle speed. Adjustment to this setting should be performed only as part of a full EEC-IV diagnosis of irregular idle conditions or idle speeds. Failure to accurately set the throttle plate stop position to the procedure below could result in erroneous idle speed control.

Instructions:

1. Place transmission in Neutral or Park and turn the A/C-Heat selector to the Off position. Apply parking brake and block wheels. If equipped with automatic brake release, disconnect the vacuum hose and plug it.
2. Bring engine to normal operating temperature.
3. Check for vacuum leaks downstream of the throttle plate.
4. Check to ensure throttle lever stop pad is resting on the throttle plate stop screw (Figure 1) and throttle linkage is not binding. Correct those conditions before proceeding.
5. Perform an EEC-IV VIP test and repair codes, refer to Section 19.
6. Perform an "idle adaptive learning cycle" by disconnecting the negative (-) terminal of the battery for 5 minutes minimum. Then reconnect the battery.
7. Start engine and check curb idle speed. If it is not controlled at 700 rpm (passenger car), 700 ± 50 rpm (Truck-automatic), 800 ± 50 rpm (Truck-manual), go on to next step.
8. Unplug spout line and verify that ignition timing is 10 degrees BTDC ± 2 degrees. Reset per ignition timing procedure if necessary.
9. Remove PCV entry line at the PCV valve and disconnect idle speed control—air bypass power lead.
10. Install orifice Tool T86P-9600-A in the PVC entry line (.200 inch diameter orifice).
11. Start engine and check idle speed with automatic transmission in Drive, manual transmission in Neutral.
12. If idle speed is not: 710 ± 20 rpm (passenger car) 900 ± 25 rpm (Truck-automatic) 1040 ± 50 rpm (Truck-manual) adjust the throttle plate stop screw (Figure 1).

    NOTE: If the electric cooling fan comes on during Step 12, unplug fan motor power lead, or wait until it switches off.
13. After idle has been set, shut engine off.
14. After waiting 3 to 5 minutes, repeat Steps 11 and 12.
15. Shut engine off and repeat Step 6.
16. Remove orifice and reconnect PCV entry line to PCV valve.
17. Reconnect spout line.

Idle Speed Setting Procedures

18. Reconnect idle speed control air bypass valve power lead.
19. Reconnect electric cooling fan.
20. Start engine and let it run 1 to 2 minutes.
21. Recheck curb idle rpm (refer to Step 7).
22. On automatic transmissions check TV pressure adjustment.

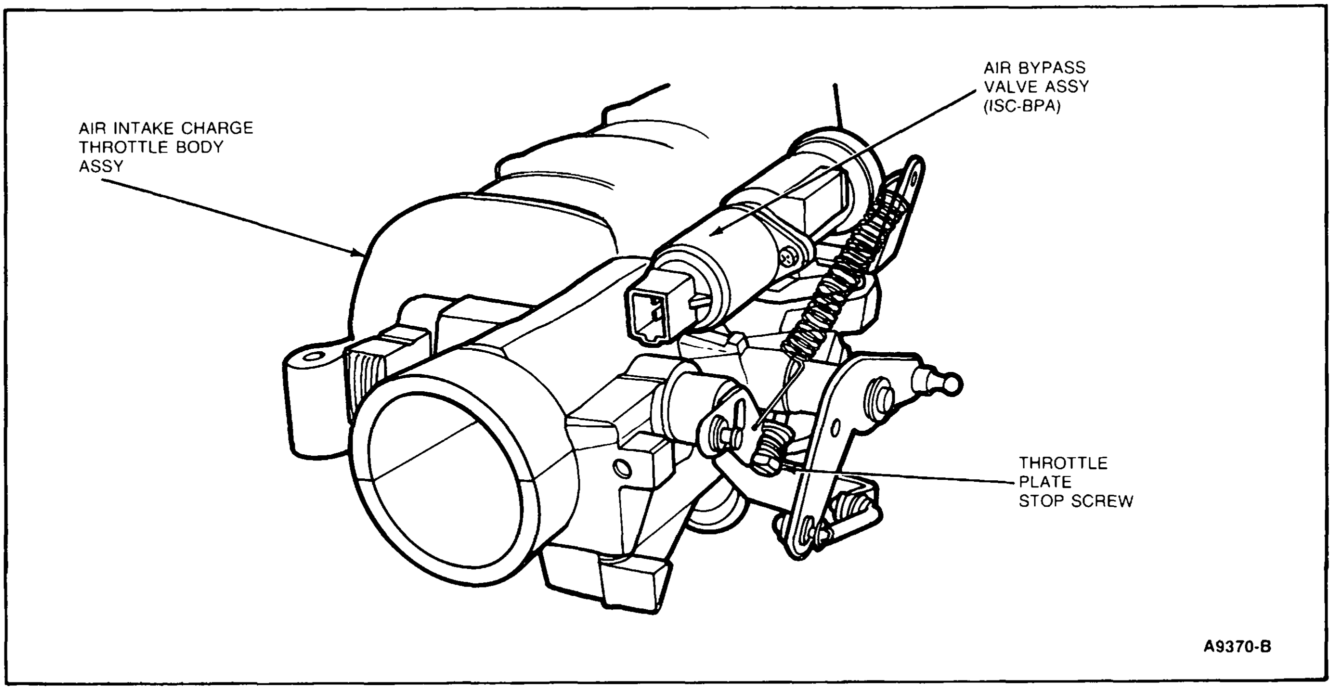


Figure 1 3.0L EFI Engine

Idle Speed Setting Procedures

PASSENGER CAR — 50 STATES

3.8L Engine w/CFI and DC Motor Idle Speed Control (ISC)

Curb Idle Speed Check:

1. Set parking brake and block wheels. If equipped with automatic brake release, disconnect the vacuum hose and plug it, when checking curb idle. Make all adjustments with engine at normal operating temperature and accessories Off.
2. After transmission is engaged in Drive and the engine is idled for 60 seconds, rpm should be within specification (refer to decal).

   NOTE: Curb and fast idle speeds are controlled by the EEC-IV processor and the idle speed control device. If the control system is operating properly, these speeds are fixed and cannot be changed by traditional adjustment techniques.

   Adjustments are sometimes required to establish the correct operating limits within which the ISC system can properly function. These adjustments, as outlined below, will normally have no direct effect on actual idle speed and generally will not be required unless:

   A. Curb idle speed is higher than specification as shown on the decal.

   or

   B. The ISC motor requires replacement.

Misadjustment of the operating limits could restrict the operating range of the ISC system, so adjustments of these limits should never be made unless a specific casual factor exists. If these operating limit adjustments do not correct an out of specification curb idle speed condition, it will be necessary to perform the appropriate 3.8L EEC-IV diagnostics.

Idle Speed Setting Procedures

Minimum ISC Limit Adjustment

If the curb idle is above specification, verify that the throttle linkage is free, that travel is unobstructed and that cruise control (if equipped) is not holding the throttle open. **If while engine is running, it is observed that the throttle lever is not in contact with the ISC motor, but held open by the throttle stop adjusting screw (TSAS), this screw must be adjusted.** This is the only reason for adjusting the TSAS as it is strictly a throttle stop and in no way affects idle speeds unless it is holding the throttle open through misadjustment. To adjust the TSAS, the ISC motor must be fully retracted. Therefore, the following TSAS adjustment procedure must be done in the exact sequence shown below:

1. Shut the engine off and remove the air cleaner. In the engine compartment, find the self-test connector and self-test input (STI) connector (Figure 1). These two connectors are located next to each other on the driver's side, behind the strut tower and on the EEC harness.
2. Connect a jumper wire between the self-test input (STI) connector and the signal return pin on the self-test connector as shown in Figure 1.

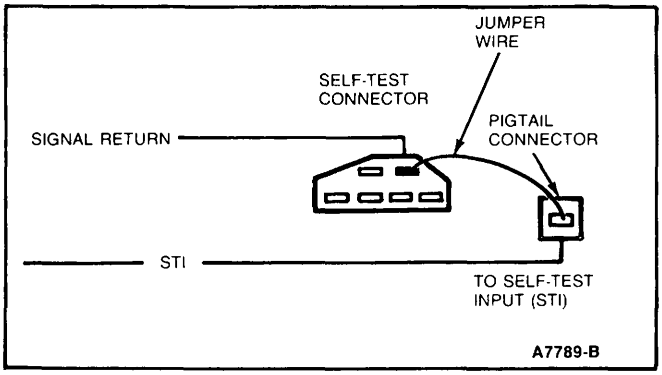


Figure 1 3.8L CFI

3. Turn the ignition key to Run. Do **not** start engine.
4. The ISC plunger will retract. Wait until plunger is fully retracted, (about ten seconds).

   NOTE: If plunger does not retract, refer to EEC-IV diagnostics.

5. Shut off key.
6. Remove jumper wire.
7. Perform throttle stop adjustments as follows:
   - Using pliers, grasp the TSAS screw threads and turn the screw (Refer to Figure 2) until it is removed from the CFI assembly. Install a new screw.
   - With the throttle plates closed, turn the new screw inward until there is a .005 inch gap between the screw tip and the throttle lever surface which it contacts.
   - Turn the screw inward an additional 1-1/2 turns.
8. Reinstall air cleaner.

Idle Speed Setting Procedures

Maximum ISC Limit Adjustment

If the ISC motor requires replacement, adjust in the exact sequence shown below.

1. Shut engine off and remove air cleaner. In the engine compartment, find the self-test connector and self-test input (STI) connector, Figure 1. These two connectors are located next to each other on the driver's side, behind the strut tower and on the EEC harness.
2. Connect a jumper wire between the STI connector and the signal return pin on the self-test connector as shown in Figure 1.
3. Turn the ignition key to Run position. Do **not** start engine.
4. The ISC plunger will retract. Wait until plunger is fully retracted (about ten seconds).

   NOTE: If plunger does not retract, refer to EEC-IV diagnostics.
5. Shut off the key.
6. Remove the jumper wire.
7. - Remove the rubber dust cover from the ISC motor tip.
   - Push the tip back toward the motor to remove any lash.
   - The gap between the ISC motor tip (which is the idle tracking switch) and the throttle lever should measure between 3/16 and 1/4 inch. If it is not within this range, loosen the ISC bracket lockscrew and adjust ISC bracket adjustment screw until a 7/32 inch drill bit will pass through the gap making only light contact with both surfaces.

     NOTE: Be sure not to push back the idle tracking switch with the drill bit before setting the clearance.
8. Retighten the lockscrew and replace the rubber dust cover.
9. Reinstall air cleaner.

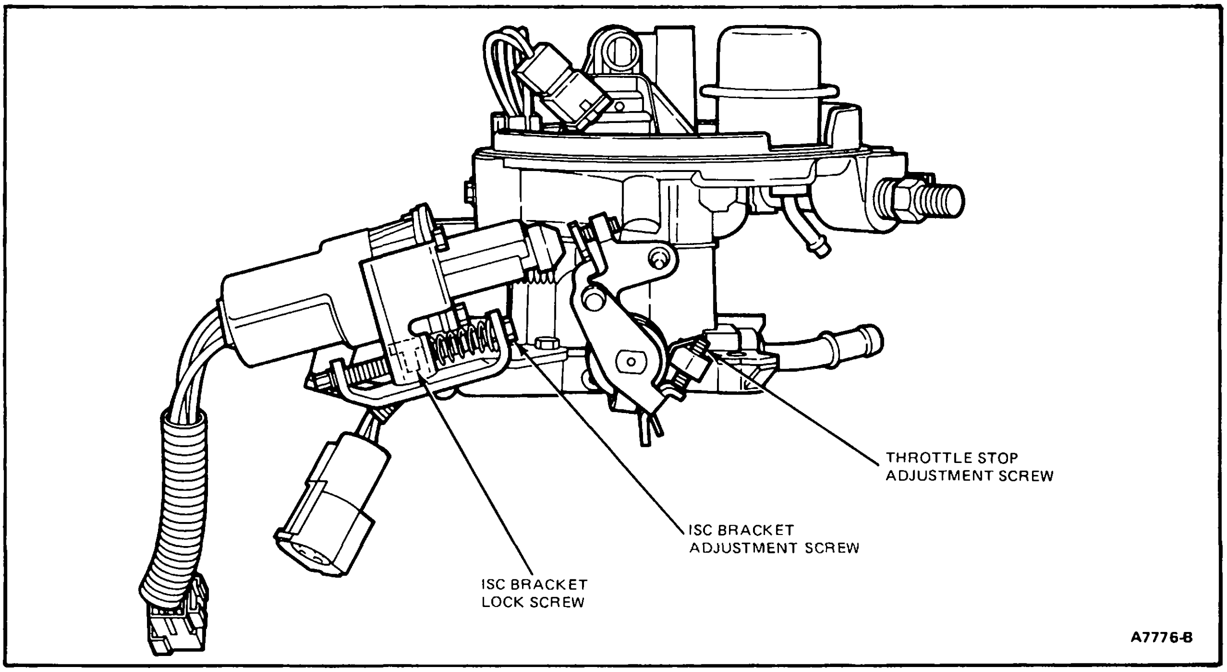


Figure 2 3.8L Engine w/CFI

Idle Speed Setting Procedures

PASSENGER CAR

5.0L Engine w/EFI and ISC

Instructions

Curb Idle Speed Check

NOTE: Curb idle speed (rpm) is controlled by the EEC-IV processor and the idle speed control bypass air solenoid (ISC-BPA). If the control system is operating properly, these speeds are self-compensating and cannot be changed by traditional adjustment techniques.

Adjustments are sometimes required to establish the correct operating limits within which the ISC-BPA system can properly function. Misadjustment of the operating limits could restrict the operating range of the ISC-BPA system, so adjustments to the system should never be made unless a specific causal factor has been identified.

Before any idle speed adjustments are attempted the following procedure should be performed:

1. Set parking brake and block wheels. If equipped with automatic brake release, disconnect the vacuum hose and plug it. Bring the engine to normal operating temperature and turn Off. Place the transmission in Park (automatic transmission) and Neutral (manual transmission). Turn the A/C-Heat selector to the Off position.
2. Verify that the throttle linkage is free, that travel is unobstructed and that the cruise control cable (if so equipped) is not holding the throttle open.
3. Check for vacuum leaks, service, as required.
4. Place transmission in Neutral and operate engine at 1800 rpm for at least 30 seconds.
5. Place transmission in Drive (A/T) or leave in Neutral for (M/T). Allow engine to stabilize.
6. Check idle speed if curb idle speed is equal to decal specification do not adjust.

Idle Speed Setting Procedures

7. If speeds exceed specification, perform EEC-IV Quick Test, Section 18, and resolve any vehicle malfunctions that are indicated by service output code; then, repeat Steps 4, 5 and 6.

8. If speeds exceed decal specification turn engine Off and disconnect the negative (-) terminal of the battery for five minutes and then re-connect. Repeat Steps 4, 5, and 6.

9. If speeds still exceed decal specification back out throttle plate screw (Figure 1) until the idle speed reaches 575 ± 20 rpm (base 5.0L A/T) 625 ± 20 rpm (5.0L H.O. A/T), 700 ± 20 rpm (5.0L H.O. M/T) then back out the throttle plate stop screw one-half additional turn to bring the throttle plate linkage into the nominal operating range of the ISC system.

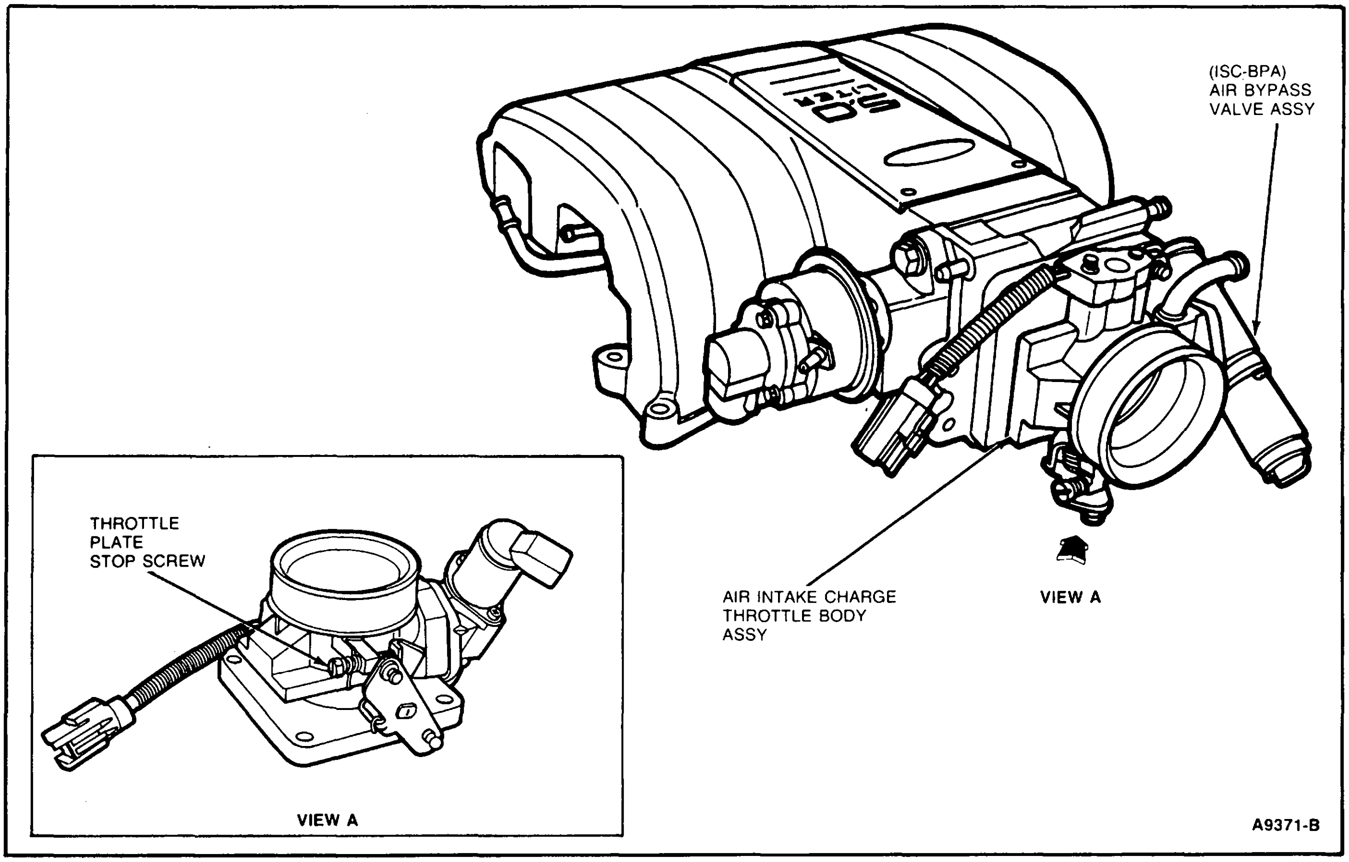


Figure 1 5.0L EFI

Idle Speed Setting Procedures

PASSENGER CAR

5.8L (W) Engine w/7200-VV — Fast Idle RPM

Instructions

1. Place the transmission in Neutral or Park. Set parking brake and block wheels. If equipped with automatic brake release, disconnect vacuum hose and plug it.
2. Bring engine to normal operating temperature.
3. Disconnect the vacuum hose at the EGR valve and plug.
4. Place the fast idle adjustment on the second step of the fast idle cam (Figure 1). Check/adjust fast idle rpm to specification.
5. Rev engine momentarily, place fast idle adjustment on the specified step and recheck fast idle rpm.
6. Remove plug from EGR vacuum hose and reconnect.

Idle Speed Setting Procedures

PASSENGER CAR

5.8L (W) Engine w/7200-VV — Curb Idle RPM

Instructions

1. Place the transmission in Neutral or Park. Set parking brake and block wheels. If equipped with automatic brake release, disconnect the vacuum hose and plug it.
2. Bring the engine to normal operating temperature.
3. Place A/C-Heat selector to the Off position.
4. Disconnect and plug the vacuum hose at the throttle kicker.
5. Place the transmission in specified position.
6. Check/adjust curb idle rpm, if adjustment is required.
   - Adjust the curb idle speed screw (Figure 2).
7. Place the transmission in Neutral or Park. Rev the engine momentarily. Place the transmission in specified position, and recheck curb idle rpm and readjust only if required.
8. Apply a slight pressure on top of the nylon nut located on the accelerator pump to take up the linkage clearance.
9. Turn the nylon nut on the accelerator pump rod clockwise until a .010 ± .005 clearance is obtained between the top of the accelerator pump and the pump lever.
10. Turn the accelerator pump rod one turn counterclockwise to set the lever lash preload.
11. Remove the plug from the throttle kicker vacuum hose and reconnect.

Idle Speed Setting Procedures

PASSENGER CAR

5.8L (W) Engine w/7200-VV — Kicker Speed Set

Instructions

1. Place the transmission in Neutral or Park. Set parking brake and block wheels. If equipped with automatic brake release, disconnect the vacuum hose and plug it.
2. Bring engine to normal operating temperature.
3. Place the A/C-Heat selector in the Off position.
4. Disconnect and plug the vacuum hose at the VOTM kicker.
5. Connect an external vacuum source providing a minimum of 33.7 kPa (10 in.-Hg.) to the VOTM kicker.
6. Place the transmission selector in the specified position.
7. Check/adjust VOTM kicker speed. If adjustment is required, loosen the saddle bracket hold-down screw, then turn the VOTM kicker speed adjusting screw. After adjustment is made, tighten the saddle bracket hold-down screw (Figure 2).
8. Remove external vacuum source. Remove plug from VOTM kicker hose and reconnect.

Idle Speed Setting Procedures

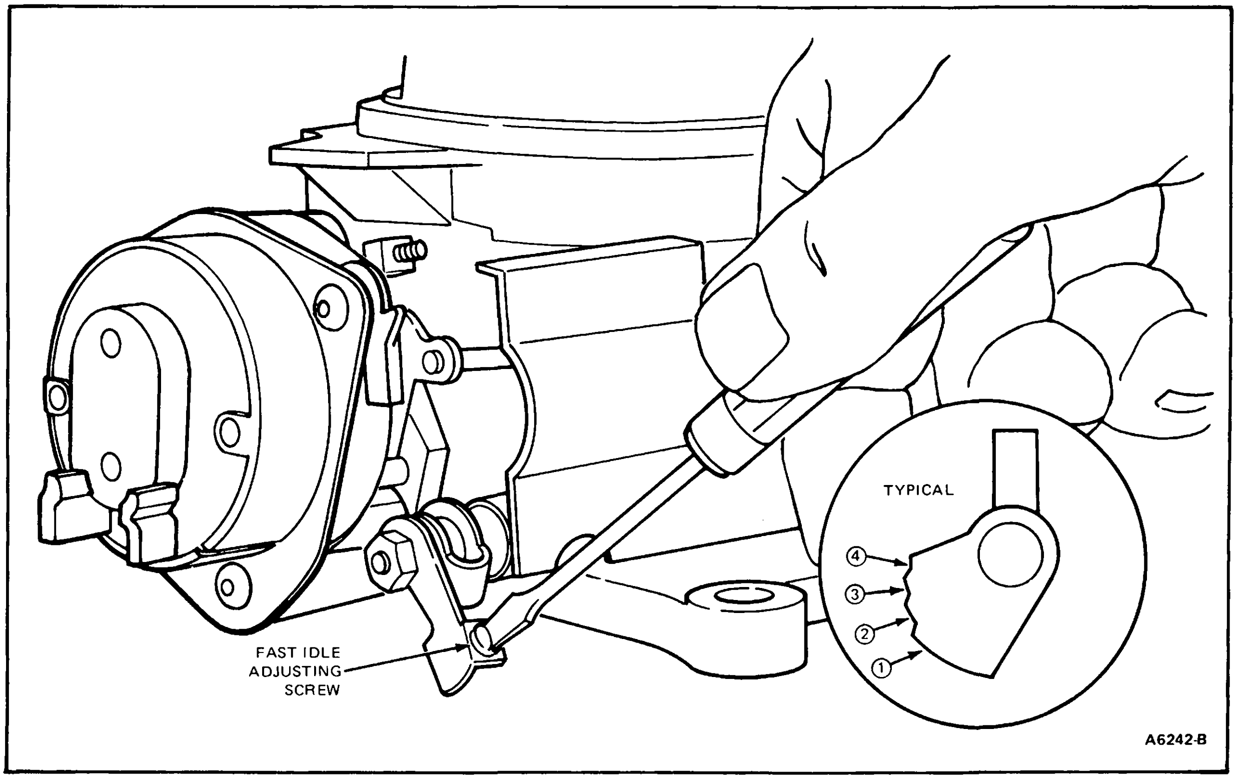


Figure 1 5.8L w/7200-VV Carburetor — Fast Idle RPM Adjustment

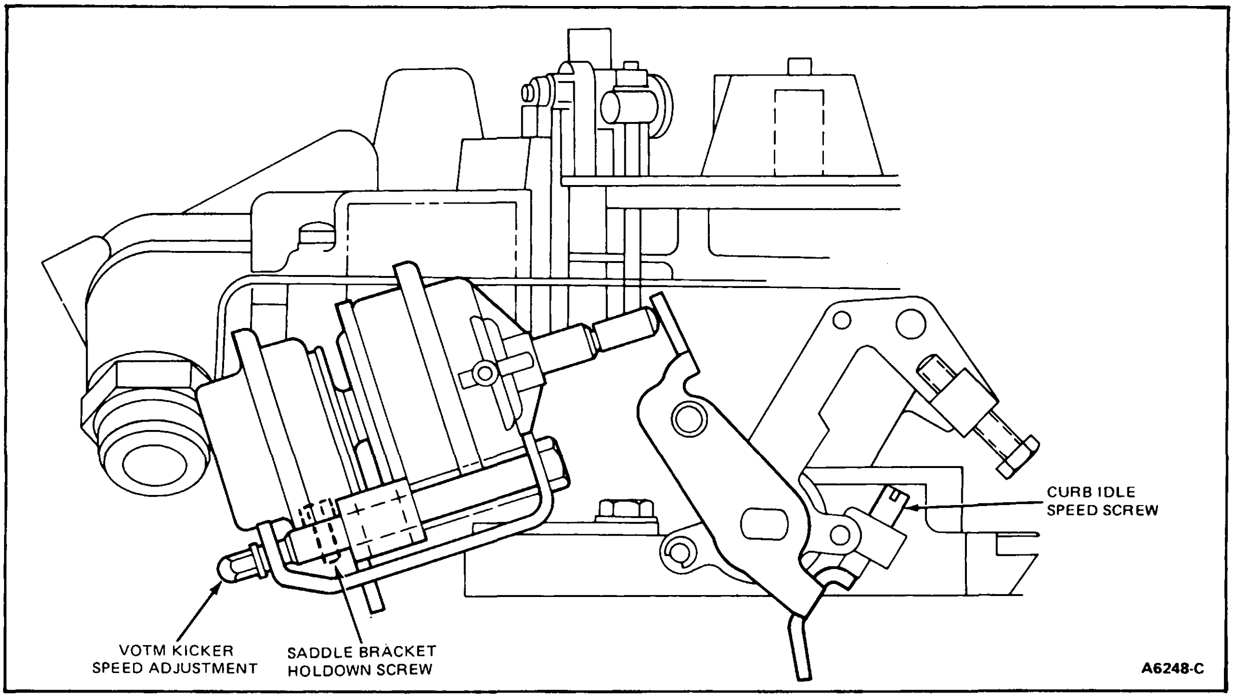


Figure 2 5.8L w/7200-VV Carburetor and VOTM (Kicker) Dashpot

Idle Speed Setting Procedures

TRUCK, UNDER 8500 GVW

2.0LEngine w/Aisan Carburetor and Electronic Idle Speed Control (ISC)—Curb Idle Speed and Fast Idle Speed Checks/Adjustments

Instructions

1. Idle Speed Verification Procedure
   a. Place the transmission in Neutral.
   b. Bring engine to normal operating temperature.
   c. Turn Off all accessories.
   d. Verify engine idle speed as specified on the VECI decal. No adjustment required.
2. Closed Throttle Fast Idle rpm/ISC Max Extension Adjustments
   a. Turn the ignition key to the Off position.
   b. Disconnect ISC DC motor connector. Disconnect the vacuum hose at the fast idle cam breaker (FICB) and plug (Figure 2). Connect insulated jumper clip leads from the battery terminals to the DC motor connector pins (Figure 3). Observe motor shaft movement with battery voltage applied.

   CAUTION: Battery voltage must not be applied to the idle tracking switch (ITS) terminals. Isolate the ITS terminals with electrical tape during this test.

   NOTE: If the motor shaft does not move, refer to Section 14 for diagnosis.

   c. If the motor extends instead of retracting, reverse polarity across the DC motor connector pins. Disconnect jumper leads after motor has fully retracted.
   d. Restart engine and check closed throttle rpm (700 or less). If adjustment is required remove tamperproof cap, refer to Section 24. Adjust throttle stop adjusting screw (Figure 2).
   e. Place the fast idle lever on the specified step (1st step) on the fast idle cam (Figure 2).
   f. Without touching the accelerator pedal: check/adjust fast idle rpm to specification. Adjust the fast idle adjusting screw (Figure 2).
   g. Rev the engine momentarily, allowing engine to return to closed throttle speed.
   h. Reconnect jumper leads to ISC motor terminals.
   i. If the motor retracts instead of extending, reverse polarity across the DC motor connector pins. Disconnect jumper leads after motor has fully extended.
   j. Check/adjust ISC full stroke speed to 2000 ± 200 rpm. Adjust the full stroke speed adjusting screw (Figure 1).
   k. Remove electrical tape from ITS terminals of DC motor connector and reconnect ISC DC motor to engine wiring harness. Remove plug from the FICB vacuum hose and reconnect.
3. Idle Speed Control (ISC) Function Check

Idle Speed Setting Procedures

NOTE: If idle speed does not adjust properly in Steps a or d, perform the diagnostic routines described in Section 14.

a. Turn Off all accessories. Idle speed should adjust to the speed specified on the VECI decal.

b. Turn ignition switch Off.

c. Disconnect engine coolant temperature (ECT) switch.

d. Restart engine. Idle speed should adjust to 1200 ± 75 rpm.

e. Turn ignition switch off, then reconnect ECT switch.

NOTE: After adjustments are completed, reconnect all parts.

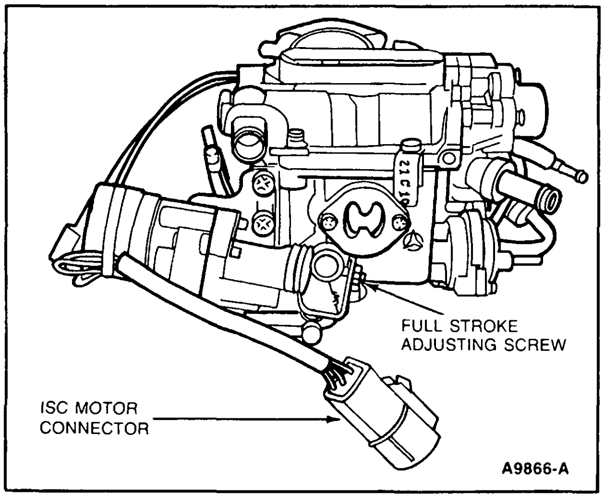


Figure 1 2.0L Engine Carburetor Full Stroke Adjustment

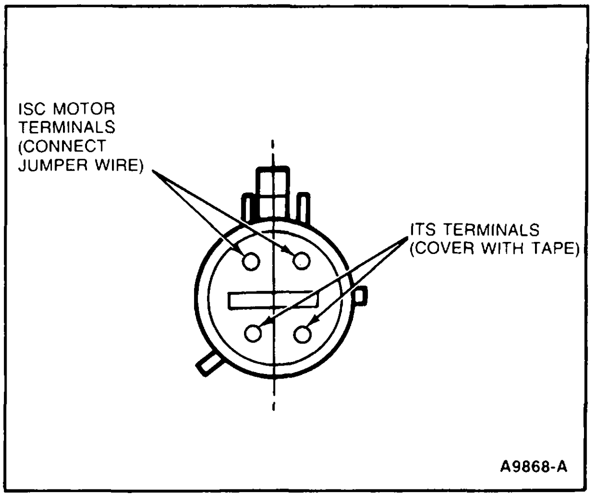

ISC MOTOR TERMINALS (CONNECT JUMPER WIRE)
ITS TERMINALS (COVER WITH TAPE)
A9868-A

Figure 3 2.0L Engine ISC Motor Connectors

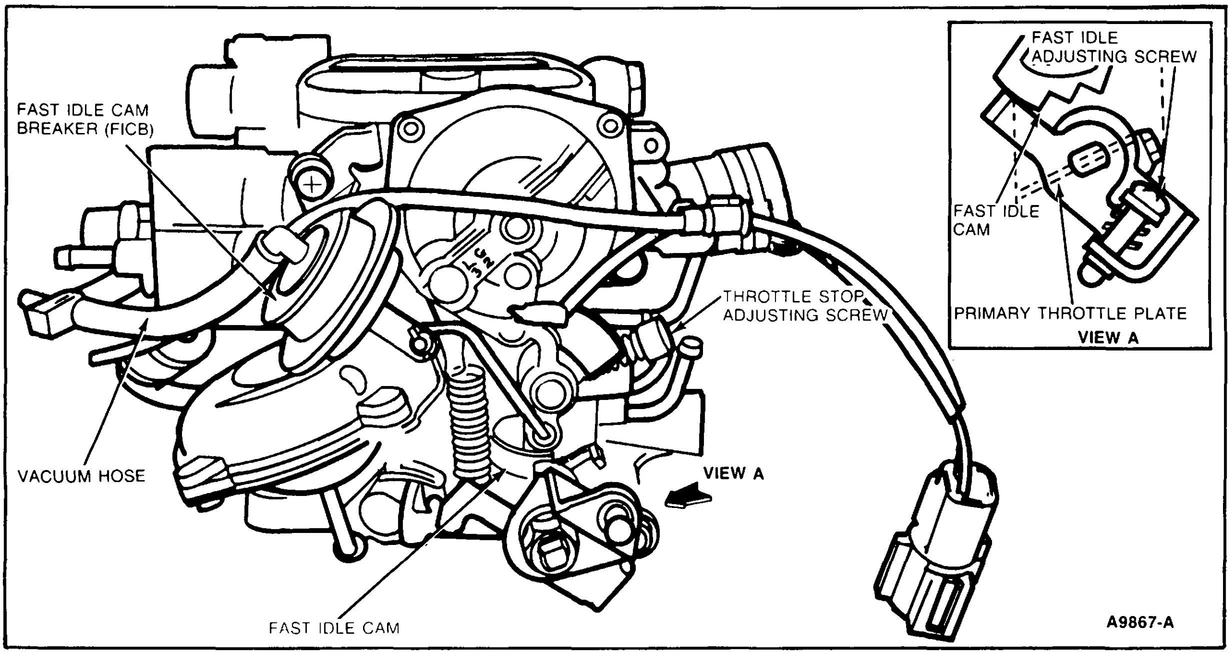

FAST IDLE CAM BREAKER (FICB)
VACUUM HOSE
THROTTLE STOP ADJUSTING SCREW
VIEW A
FAST IDLE CAM
FAST IDLE ADJUSTING SCREW
FAST IDLE CAM
PRIMARY THROTTLE PLATE
VIEW A
A9867-A

Figure 2 2.0L Engine Carburetor Fast Idle and Throttle Stop Adjustment

Idle Speed Setting Procedures

TRUCK, UNDER 8500 GVW

2.9L EFI

Instructions

This procedure is to be performed only if the curb idle is not to decal specification.

NOTE: Curb idle speed (rpm) is controlled by the EEC-IV processor and the idle speed control air bypass (ISC-BPA) valve assembly (Figure 1). If engine curb idle rpm is not within specification after performing this procedure, it will be necessary to perform the appropriate 2.9L EFI EEC-IV diagnostics.

1. Place the transmission in Neutral, turn the A/C-Heat selector to the Off position.
2. Bring the engine to normal operating temperature and turn Off.
3. Disconnect the idle speed control air bypass valve power lead (ISC-BPA).
4. Start engine and operate at 2,000 rpm for 120 seconds.
5. Let engine idle and check base idle rpm (650 ± 50 rpm man, 700 ± 25 rpm Auto).
6. Adjust engine rpm to specification by adjusting throttle plate stop screw (Figure 1).
7. Turn engine off, restart and check base idle rpm; readjust if necessary.
8. Shut engine off and reconnect.
   - Power lead to idle speed control air bypass valve (ISC-BPA).
9. Verify throttle plate is not stuck in the bore by existing throttle plate.

NOTE: If excessive engine idle speeds are experienced when driving the vehicle on the idle system, turn the ignition switch to Off position and restart.

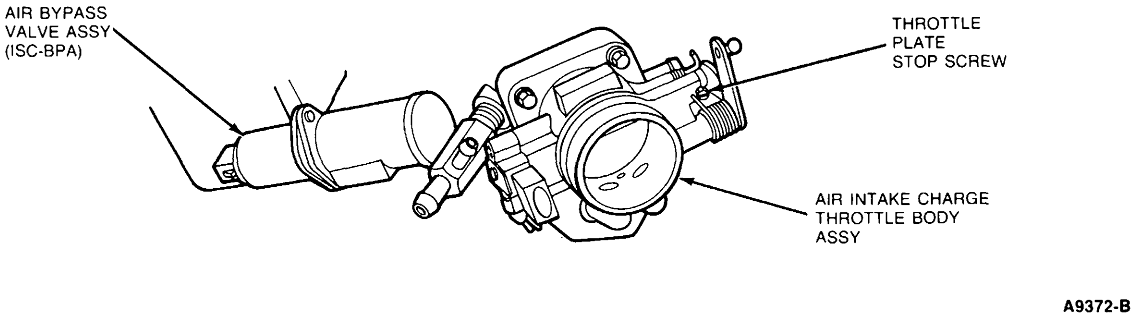

AIR BYPASS VALVE ASSY (ISC-BPA)
THROTTLE PLATE STOP SCREW
AIR INTAKE CHARGE THROTTLE BODY ASSY
A9372-B

Figure 1 2.9L EFI Engine

Idle Speed Setting Procedures

TRUCK, UNDER 8500 GVW AND OVER 8500 GVW

4.9L, 5.0L Engine w/EFI

Instructions

Curb Idle Speed Check

NOTE: Curb idle speed (RPM) is controlled by the EEC-IV processor and the idle speed control bypass air solenoid (ISC-BPA). If the control system is operating properly, these speeds are self-compensating and cannot be changed by traditional adjustment techniques.

Adustments are sometimes required to establish the correct operating limits within which the ISC-BPA system can properly function. Misadjustment of the operating limits could restict the operating range of the ISC-BPA system, so adjustments to the system should never be made unless a specific causal factor has been identified.

Before any idle speed adjustments are attempted the following procedure should be performed:

1. Set parking brake and block wheels. Bring the engine to normal operating temperature and turn Off. Place the transmission in Neutral/Park. Turn the A/C-Heat selector to the Off position.
2. Verify that the throttle linkage is free, that travel is unobstructed and that the cruise control cable (if so equipped) is not holding the throttle open.
3. Check for vacuum leaks, service as required.
4. Place transmission in Neutral and operate engine at 1800 rpm for at least 30 seconds.
5. Place transmission in Drive (A/T) or leave in Neutral for (M/T). Allow engine to stabilize and check idle speed within 30 seconds. After 30 seconds the idle speed may increase because of strategy parameters. Note: If engine is idling longer than 30 seconds, repeat Step 4.
6. If curb idle speed is equal to or less than specified on the Decal, do not adjust.

Idle Speed Setting Procedures

7. If speeds exceed those specified on the Decal, turn engine Off and disconnect the negative (-) terminal of the battery for 5 minutes and then re-connect. Repeat Steps 4, 5 and 6.
8. If speeds exceed specification, perform EEC-IV Quick Test, Section 18 and resolve any vehicle malfunctions that are indicated by service output code; then repeat Steps 4, 5 and 6.
9. If speeds still exceed those specified on the Decal, back out throttle plate stop screw (Figure 1) until the idle speed reaches 600 ± 20 rpm (A/T) or 700 ± 20 rpm (M/T) then back out the throttle plate stop screw one-half additional turn to bring the throttle plate linkage into the nominal operating range of the ISC-BPA system.

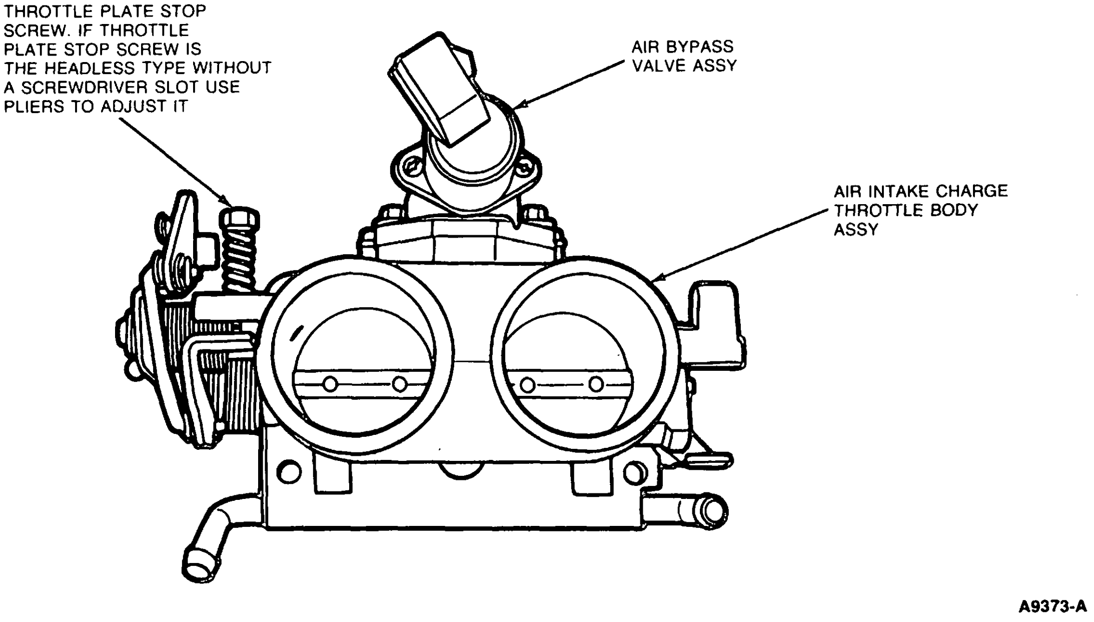

THROTTLE PLATE STOP SCREW. IF THROTTLE PLATE STOP SCREW IS THE HEADLESS TYPE WITHOUT A SCREWDRIVER SLOT USE PLIERS TO ADJUST IT
AIR BYPASS VALVE ASSY
AIR INTAKE CHARGE THROTTLE BODY ASSY
A9373-A

Figure 1 4.9L, 5.0L EFI

Idle Speed Setting Procedures

TRUCK, UNDER 8500 GVW

5.8L Engine w/4180C-4V—Fast Idle RPM

Instructions

1. Set parking brake, block wheels and place the transmission in Neutral or Park.
2. Bring engine to normal operating temperature.
3. Disconnect the vacuum hose at the carburetor EGR port and cap the port.
4. Disconnect and plug the manifold vacuum source from the air cleaner TVS (large port) and air cleaner bimetal.
5. Place the fast idle adjustment on the specified step of the fast idle cam. Check/adjust fast idle rpm to specification, (Figure 1).
6. Rev engine momentarily, place fast idle adjustment on the specified step and recheck fast idle rpm.
7. Remove plug from EGR port and reconnect vacuum hose.

Idle Speed Setting Procedures

TRUCK, UNDER 8500 GVW

5.8L Engine w/4180C-4V—Curb Idle RPM

1. Set parking brake, block wheels and place the transmission in neutral or park.
2. Bring the engine to normal operating temperature.
3. Place A/C—heat selector to the off position.
4. Disconnect and plug manifold vacuum source from the air cleaner TVS (large port) and air cleaner bimetal.
5. Place the transmission in specified position.
6. Check/adjust curb idle rpm, if adjustment is required. Adjust the curb idle speed screw (Figure 2).
7. Place the transmission in Neutral or Park, rev the engine momentarily. Place the transmission in specified position and recheck curb idle rpm, readjust only if required.
8. Connect an external vacuum source providing a minimum of 33.7 kPa (10 in.-Hg.) to the VOTM kicker.
9. Place the transmission selector in specified position.
10. Check/adjust VOTM kicker speed. If adjustment is required, loosen kicker locknut and turn kicker to required speed, tighten locknut (Figure 2).
11. Remove plugs and reconnect vacuum hoses.

Idle Speed Setting Procedures

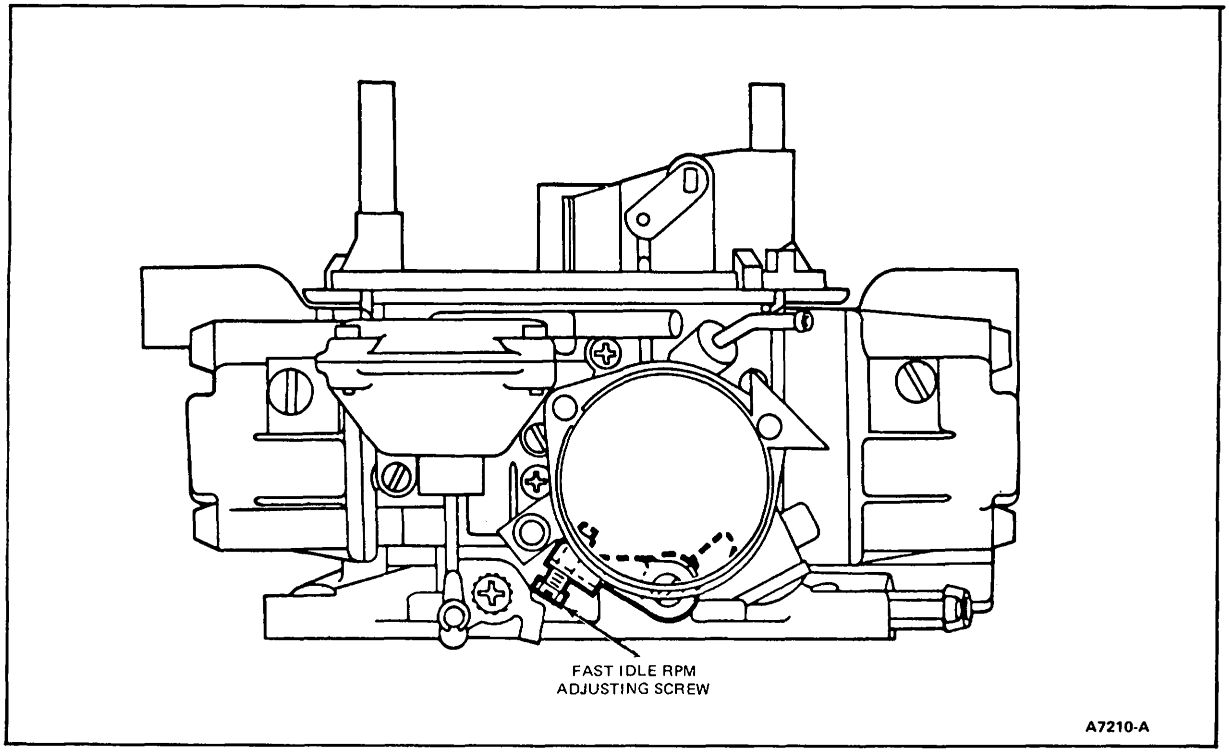


Figure 1 5.8L w/4180C-4V Carburetor — Fast Idle RPM Adjustment

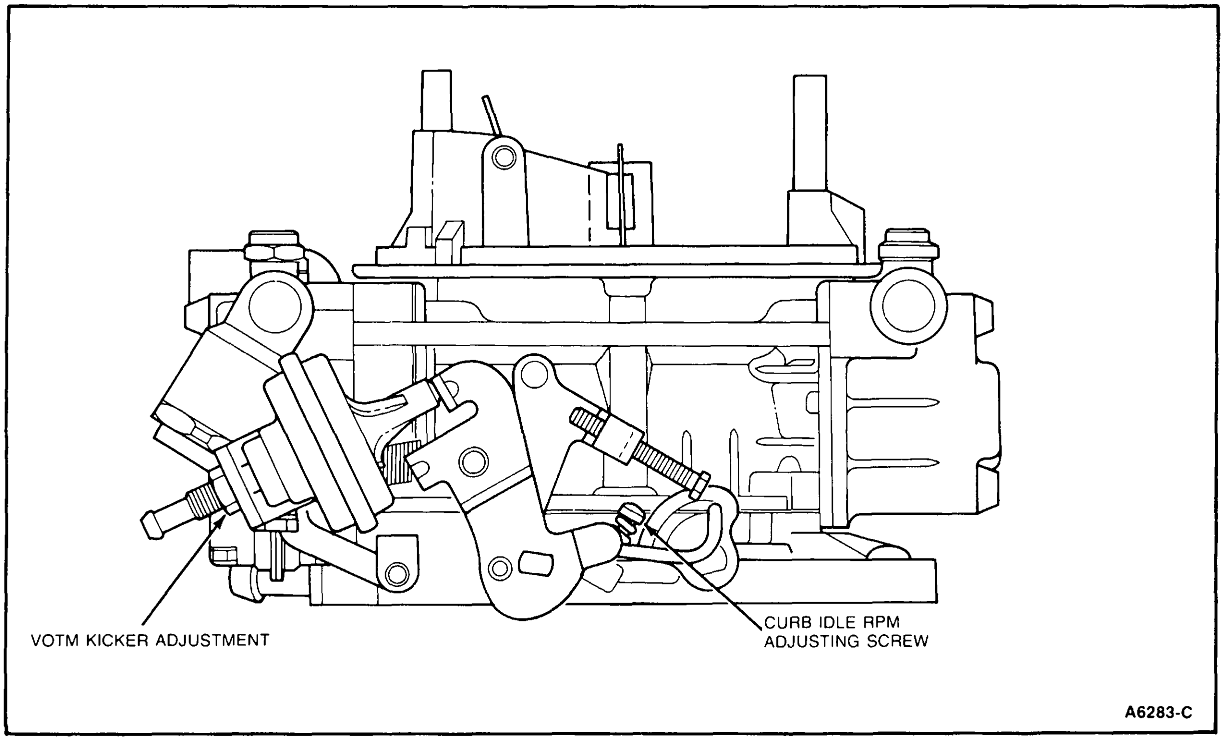


Figure 2 5.8L w/4180C-4V A/C Throttle Control Kicker and Curb Idle RPM Adjustment

Idle Speed Setting Procedures

TRUCK, OVER 8500 GVW

5.8L Engine w/4180C-4V — Fast Idle RPM

Instructions

1. Set parking brake, block wheels, and place the transmission in Neutral or Park.
2. Bring engine to normal operating temperature.
3. Disconnect and plug the vacuum hoses at the EGR valve, and the air cleaner.
4. Place the fast idle adjustment on the specified step of the fast idle cam. Check/adjust fast idle rpm to specification (Figure 1).
5. Rev engine momentarily, place fast idle adjustment on the specified step and recheck fast idle rpm.
6. Remove plug from EGR valve and reconnect.

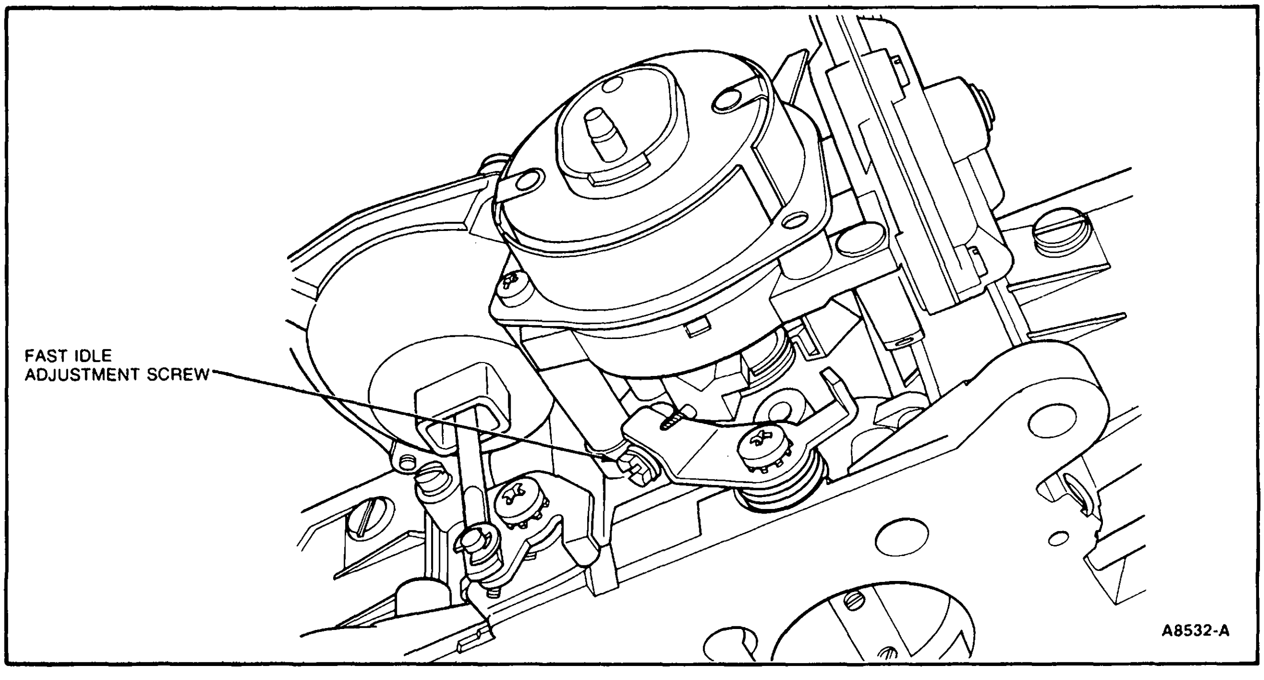


Figure 1 5.8L w/4180C-4V Carburetor—Fast Idle RPM Adjustment

Idle Speed Setting Procedures

TRUCK, OVER 8500 GVW

5.8L Engine w/4180C-4V — Curb Idle RPM

Instructions	MAN	AUTO
1. Set parking brake, block wheels and place the transmission in neutral or park.	X	X
2. Bring the engine to normal operating temperature.	X	X
3. Place A/C-heat selector to the off position.	X	X
4. Disconnect and plug vacuum hoses at EGR valve and the air cleaner.	X	X
5. Place the transmission in specified position.	X	X
6. Check/adjust curb idle RPM, if adjustment is required. Adjust the curb idle speed screw Refer to Fig.	X 2	X 3
7. Place the transmission in Neutral or Park, rev the engine momentarily. Place the transmission in specified position and recheck curb idle rpm, readjust only if required.	X	X
8. Check/adjust dashpot clearance by totally compressing the dashpot and adjusting for .100 inch clearance between collapsed dashpot and throttle lever at the closed throttle position. (Figure 2).	X	
9. Reconnect vacuum hoses.	X	X

Idle Speed Setting Procedures

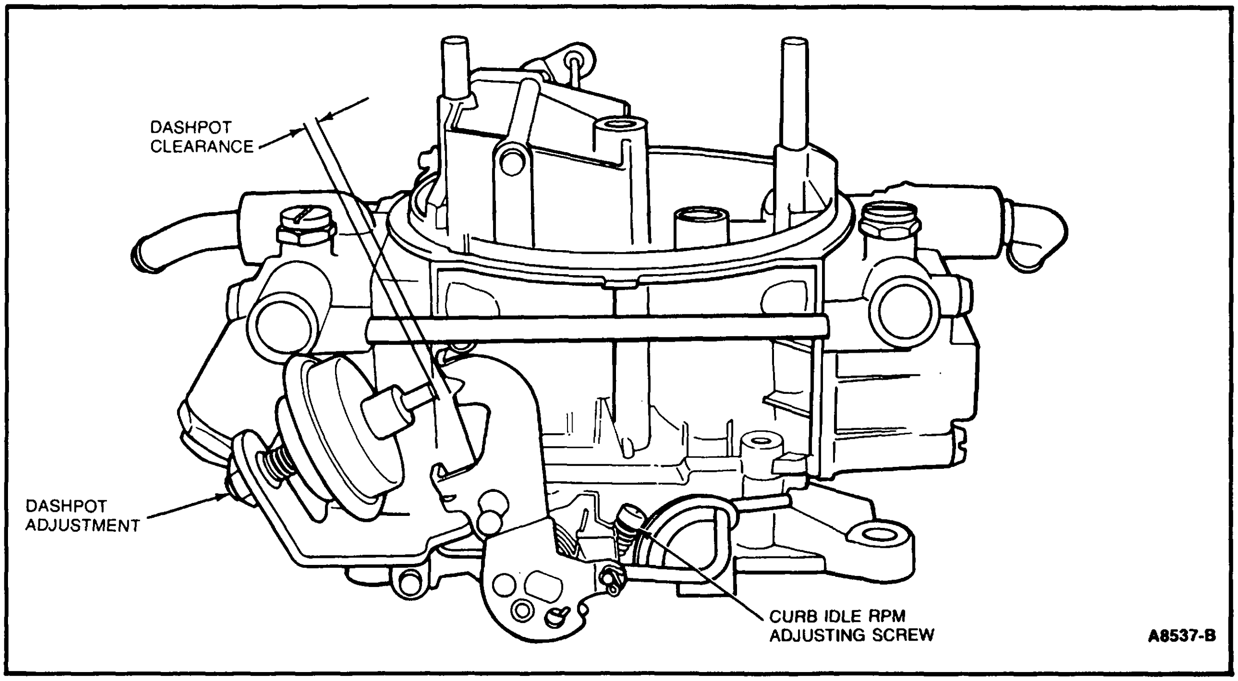


Figure 2 5.8L w/4180-4V Manual Transmission with Dashpot

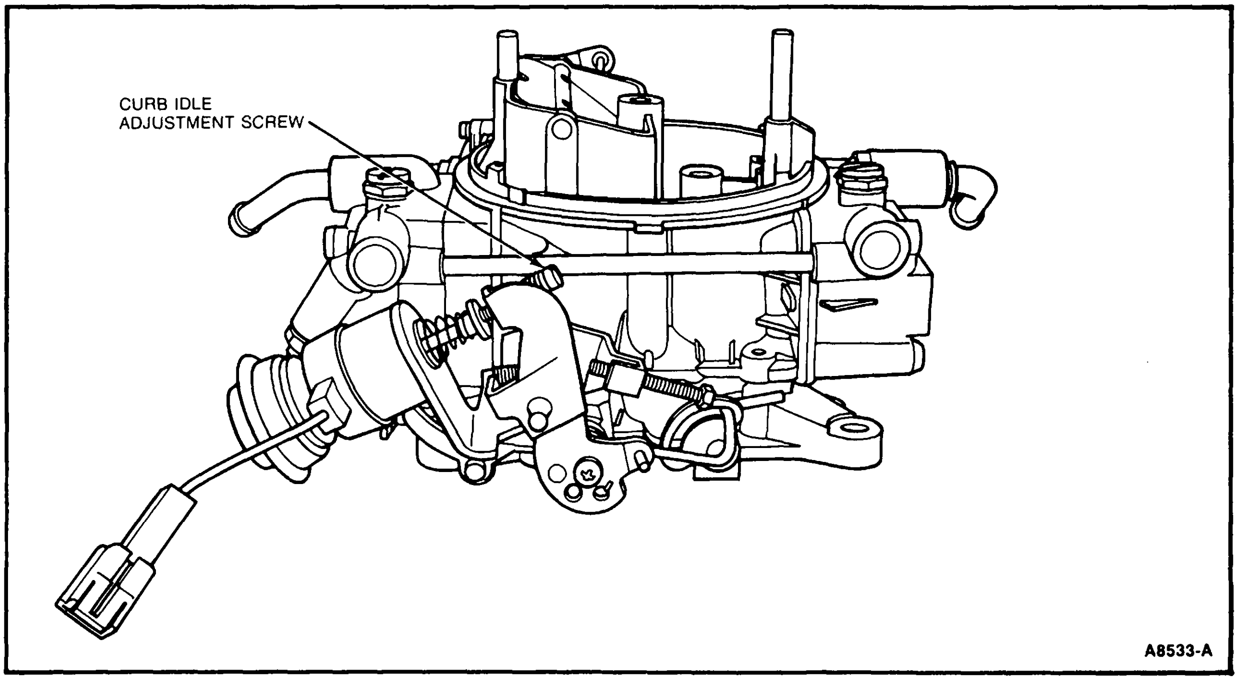


Figure 3 5.8L w/4180C-4V A/C Automatic Transmission Throttle Control Kicker and Curb Idle RPM Adjustment

Idle Speed Setting Procedures

TRUCK, OVER 8500 GVW

6.1L & 7.0L Engines—Fast Idle RPM

Carburetor Model Number Calibration Numbers	6.1L 4190EG-4V 9-83H-R11 4-83T-R00	7.0L 4190EG-4V 9-87G-R11	6.1L 4190EG-4V 5-83H-R00	7.0L 4190EG-4V 5-87H-R00
Instructions				
1. Stabilize engine temperature.	X	X	X	X
2. Place the vehicle in Park or Neutral, A/C in Off position, and set parking brake.	X	X	X	X
3. Remove air cleaner.	X	X	X	X
4. Disconnect and plug throttle decel control diaphragm vacuum hose.	X	X	NA	NA
5. Disconnect and plug evaporative emission purge valve hose.	X	X	X	X
6. Disconnect and plug EGR valve vacuum hose.	X	X	X	X
7. Bypass vacuum retard delay valve in distributor advance line with vacuum hose.	X	X	X	X
8. Depress accelerator pedal fully, pull choke control to full choke and release accelerator pedal.	X	X	X	X

(Continued)

Idle Speed Setting Procedures

TRUCK, OVER 8500 GVW

6.1L & 7.0L Engines—Fast Idle RPM

	6.1L	7.0L	6.1L	7.0L
Carburetor Model Number	4190EG-4V	4190EG-4V	4190EG-4V	4190EG-4V
Calibration Numbers	9-83H-R11 4-83T-R00	9-87G-R11	5-83H-R00	5-87H-R00
Instructions				
9. Check/adjust choke plate pulldown clearance. a. Move the choke operating lever to the first detent (Figure 6).	NA	NA	X	X
b. Measure the choke plate pulldown clearance using a size "A" (234 in.) drill. Place the drill between the air horn wall and lower edge of the choke plate.	NA	NA	X	X
c. Adjust the clearance if necessary by bending the choke link (Figure 7).	NA	NA	X	X
10. Check/adjust fast idle rpm. Insert a 0.375-inch gauge between choke plate and air horn in the downstream side of the choke plate. Adjust fast idle rpm by turning fast idle adjusting screw (Figure 6).	X	X	X	X

(Continued)

Idle Speed Setting Procedures

TRUCK, OVER 8500 GVW

6.1L & 7.0L Engines—Fast Idle RPM

Carburetor Model Number Calibration Numbers	6.1L 4190EG-4V 9-83H-R11 4-83T-R00	7.0L 4190EG-4V 9-87G-R11	6.1L 4190EG-4V 5-83H-R00	7.0L 4190EG-4V 5-87H-R00
Instructions				
11. Remove the plug from the EGR vacuum hose and reconnect.	X	X	X	X
12. Remove bypass hose and reinstall the vacuum retard delay valve.	X	X	X	X
13. Remove the plug from the evaporative emission purge valve hose and reconnect.	X	X	X	X
14. Remove the plug from the throttle decel control diaphragm vacuum hose and reconnect.	X	X	NA	NA
15. Reinstall air cleaner.	X	X	X	X

Idle Speed Setting Procedures

TRUCK, OVER 8500 GVW

6.1L & 7.0L Engines—Curb Idle Speed Decel Throttle Control Speed and Anti-Dieseling Set Speed

	6.1L	7.0L	6.1L	7.0L
Carburetor Model Number	**4190EG-4V**	**4190EG-4V**	**4190EG-4V**	**4190EG-4V**
Calibration Numbers	**9-83H-R11** **4-83T-R00**	**9-87G-R11**	**5-83H-R00**	**5-87H-R00**
Instructions				
1. Stabilize engine temperature.	X	X	X	X
2. Place the vehicle in Park or Neutral, A/C in Off position, and set parking brake.	X	X	X	X
3. Disconnect hot and cold air supply from air cleaner.	NA	NA	X	X
4. Remove air cleaner.	X	X	X	X
5. Disconnect and plug decel throttle control kicker diaphragm vacuum hose.	X	X	NA	NA
a. Connect a slave vacuum hose from an engine manifold vacuum source to the decel throttle control kicker.	X	X	NA	NA
b. Run engine at approximately 2500 rpm for 15-seconds, then release the throttle.	X	X	NA	NA

(Continued)

Idle Speed Setting Procedures

TRUCK, OVER 8500 GVW

6.1L & 7.0L Engines—Curb Idle Speed Decal Throttle Control Speed and Anti-Dieseling Set Speed

Carburetor Model Number **Calibration Numbers**	**6.1L** **4190EG-4V** **9-83H-R11** **4-83T-R00**	**7.0L** **4190EG-4V** **9-87G-R11**	**6.1L** **4190EG-4V** **5-83H-R00**	**7.0L** **4190EG-4V** **5-87H-R00**
Instructions				
c. If decel throttle control rpm is not within ± 50 rpm of specification, adjust the kicker. Refer to Figure.	X 1 or 3	X 1 or 3	NA	NA
d. Disconnect the slave vacuum hose and allow engine to return to curb idle.	X	X	NA	NA
6. Adjust curb idle, if necessary, using the curb idle adjusting screw with transmission in Neutral for manual and in Drive for automatic. Refer to Figure.	X 2 or 4	X 2 or 4	X 5	X 5

(Continued)

Idle Speed Setting Procedures

TRUCK, OVER 8500 GVW

6.1L & 7.0L Engines—Curb Idle Speed Decel Throttle Control Speed and Anti-Dieseling Set Speed

	6.1L	7.0L	6.1L	7.0L
Carburetor Model Number	**4190EG-4V**	**4190EG-4V**	**4190EG-4V**	**4190EG-4V**
Calibration Numbers	**9-83H-R11** **4-83T-R00**	**9-87G-R11**	**5-83H-R00**	**5-87H-R00**
Instructions				
7. Rev the engine momentarily, recheck curb idle and adjust if necessary.	X	X	X	X
8. With solo-pot collapsed (de-energized), set the anti-dieseling set speed if necessary by adjusting the screw on the main carburetor body unitl specified rpm is attained. Refer to Figure 5.	NA	NA	X	X
9. Reconnect the decel throttle control vacuum hose to the diaphragm.	X	X	NA	NA
10. Reinstall the air cleaner.	X	X	X	X
11. Reinstall shed system hose and hot and cold air supply systems.	NA	NA	X	X

Idle Speed Setting Procedures

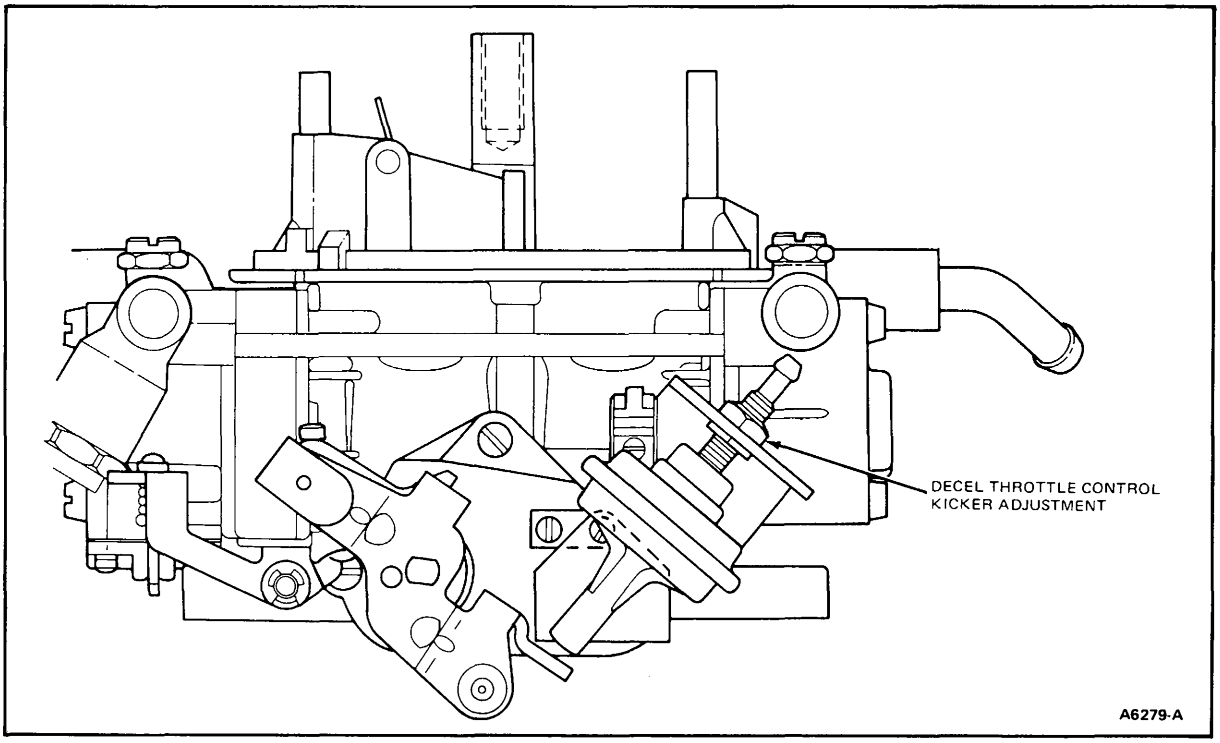


Figure 1 6.1L Engine w/4190EG-4V (Calibration 9-83H-R11 or 4-83T-R00), 7.0L Engine w/4190EG-4V (Calibration 9-87G-R11) — Decel Throttle Control Kicker

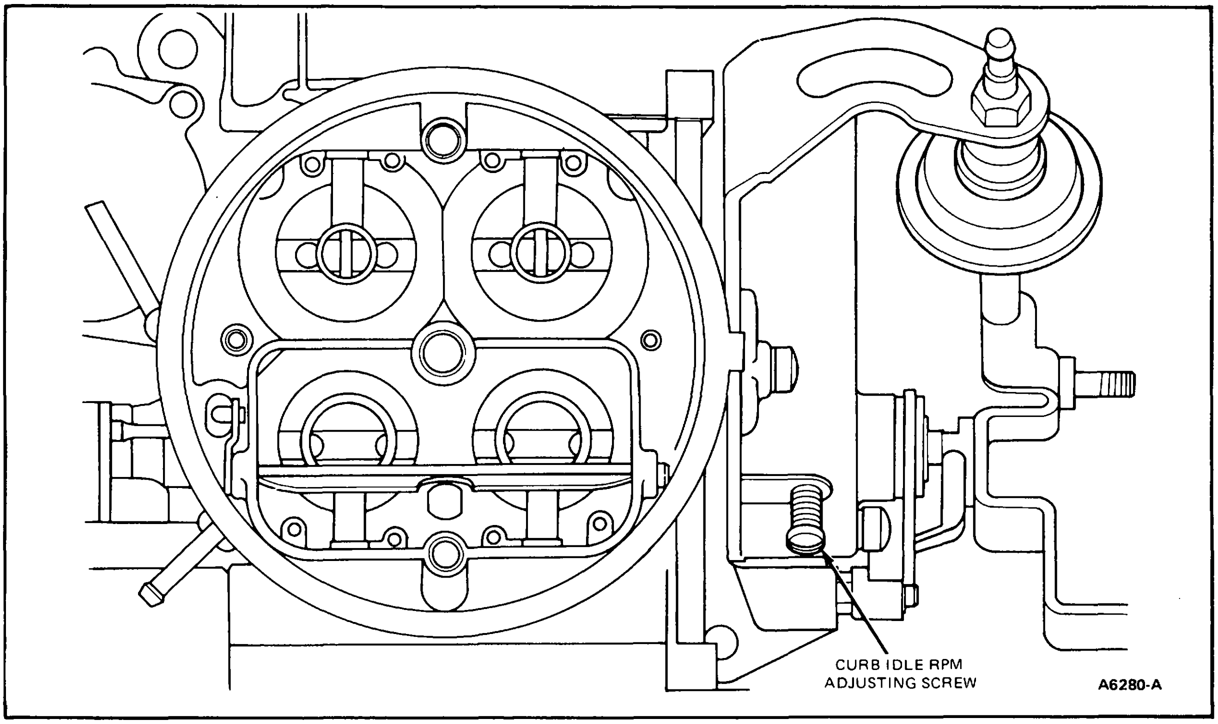


Figure 2 6.1L Engine w4190EG-4V (Calibration 9-83H-R11 or 4-83T-R00), 7.0L Engine w/4190EG-4V (Calibration 9-87G-R11) — Curb Idle RPM

Idle Speed Setting Procedures

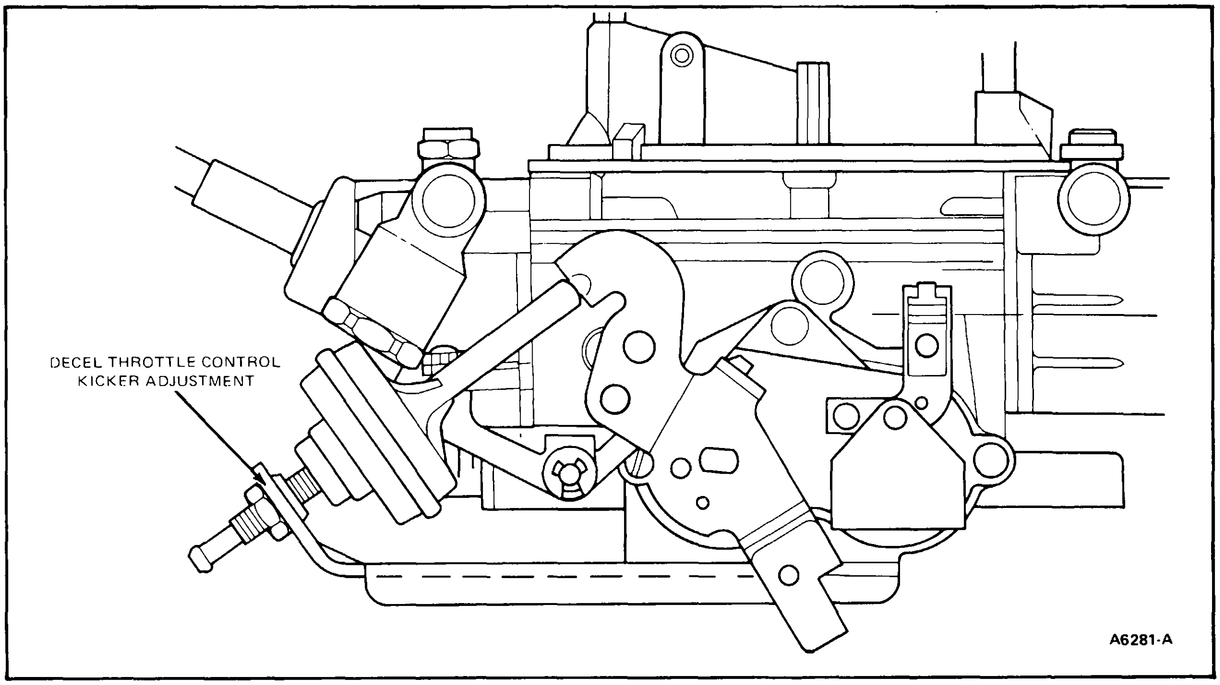


Figure 3 6.1L Engine w/4190EG-4V (Calibration 9-83H-R11 or 4-83T-R00), 7.0L Engine w/4190EG-4V (Calibration 9-87G-R11) — Decel Throttle Control Kicker

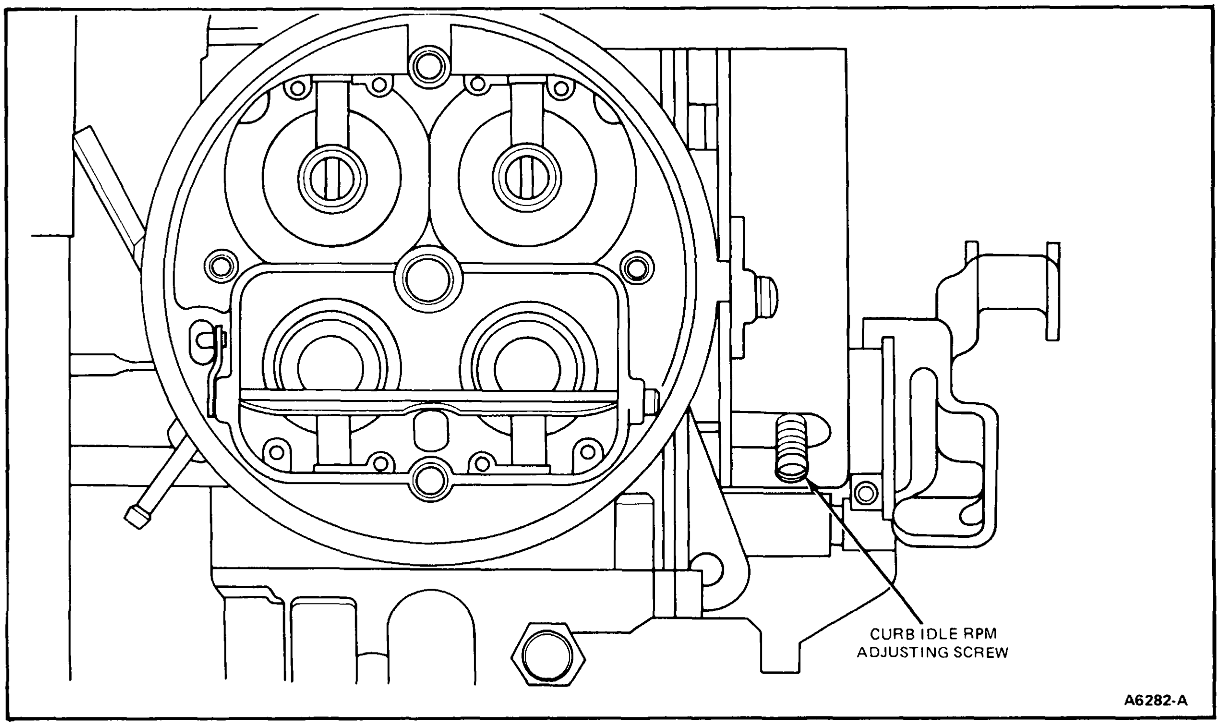


Figure 4 6.1L Engine w/4190EG-4V (Calibration 9-83H-R11 or 4-83T-R00), 7.0L Engine w/4190EG-4V (Calibration 9-87G-R11) — Curb Idle RPM

Idle Speed Setting Procedures

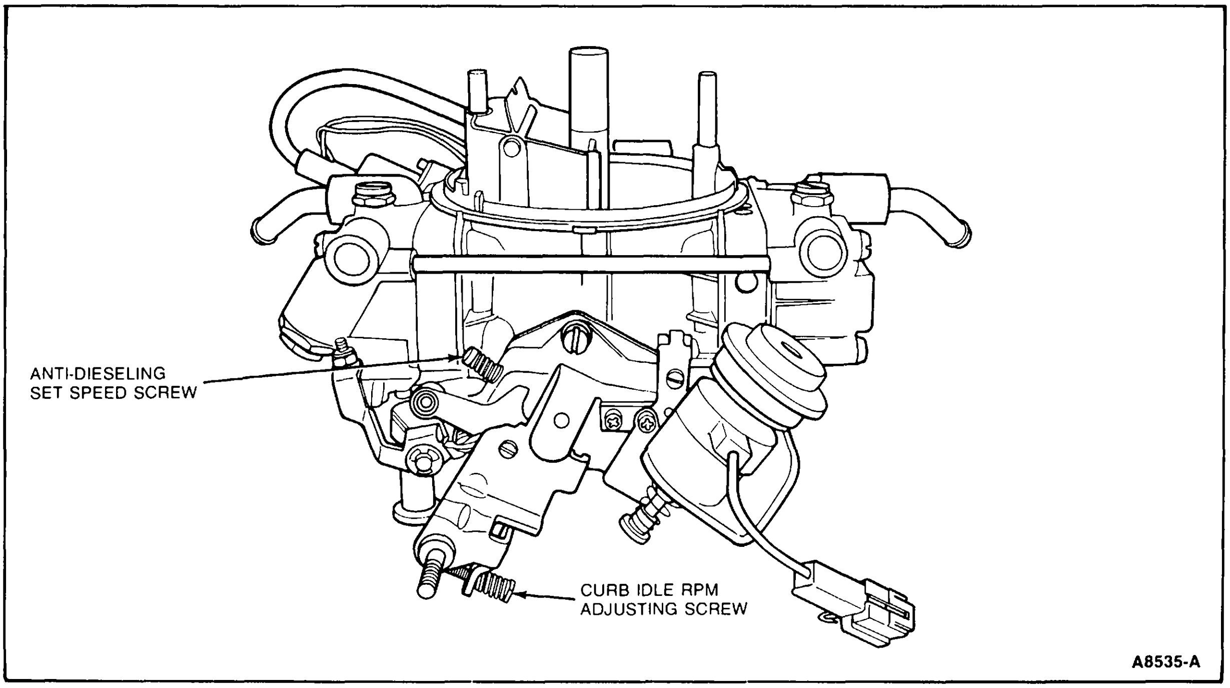


Figure 5 6.1L and 7.0L Engines w/4190EG-4V (Calibration 5-83H-R00 or 5-87H-R00) — Curb Idle and Anti-Dieseling Adjustments

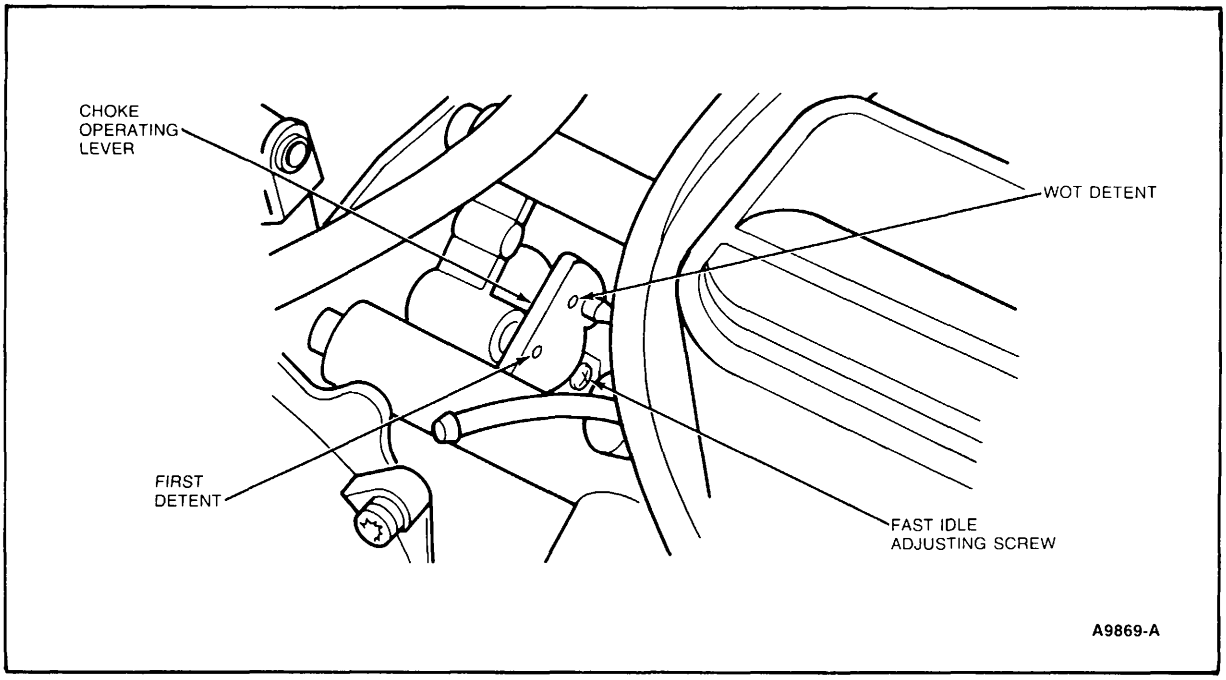


Figure 6 6.1L/7.0L Engines w/4190EG-4V — Fast Idle Speed Adjustment

Idle Speed Setting Procedures

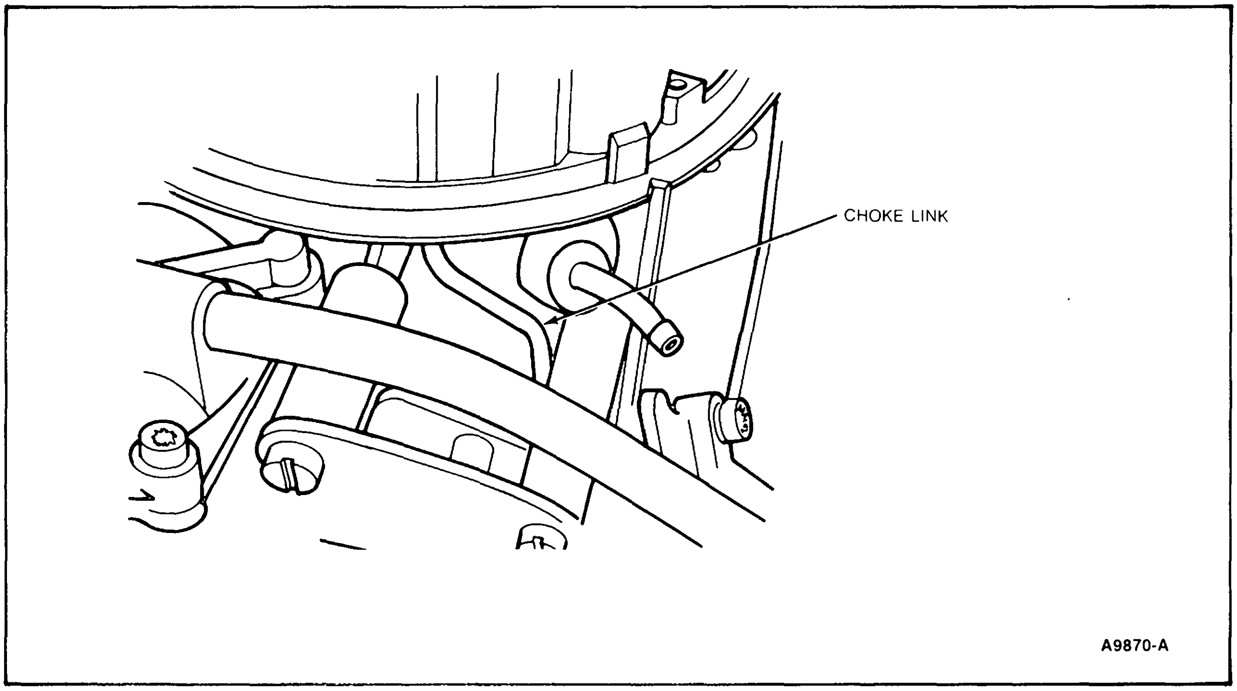


Figure 7 6.1L/7.0L Engines w/4190EG-4V — Choke Plate Pulldown Clearance Adjustment

Idle Speed Setting Procedures

TRUCK, OVER 8500 GVW

7.5L Engine—Fast Idle RPM

Carburetor Model Number	4180C-4V	4180C-4V
Calibration Numbers	6-97J-R12 6-98J-R18	4-98S-R11
Instructions		
1. Stabilize engine temperature.	X	X
2. Place the vehicle in Park or Neutral, A/C in Off Position, and set parking brake.	X	X
3. Remove air cleaner.	X	X
4. Disconnect and plug throttle decel control diaphragm vacuum hose.	NA	X
5. Disconnect and plug evaporative emission purge valve hose at EGR valve.	NA	X
6. Disconnect and plug EGR valve vacuum hose.	X	X
7. Depress the throttle lever and manually rotate the fast idle cam until the fast idle screw rests on the High Cam position (Top Step, Refer to Figure 3)	X	X
8. Check/adjust fast idle rpm.	X	X
9. Remove the plug from the EGR vacuum hose and reconnect.	X	X
10. Remove the plug from the evaporative emission purge valve hose and reconnect.	NA	X
11. Remove the plug from the throttle decel control diaphragm vacuum hose and reconnect.	NA	X
12. Reinstall air cleaner.	X	X

Idle Speed Setting Procedures

TRUCK, OVER 8500 GVW

7.5L Engine—Curb Idle Speed and Decel Throttle Control Speed

Carburetor Model Number	**4180C-4V**	**4180-4V**
Calibration Numbers	**4-98S-R11**	**6-97J-R12** **6-97J-R18**
Instructions		
1. Stabilize engine temperature.	X	X
2. Place the vehicle in Park or Neutral, A/C in Off position, and set parking brake.	X	X
3. Remove air cleaner.	X	X
4. Disconnect and plug decel throttle control kicker diaphragm vacuum hose.	X	NA
a. Connect a slave vacuum hose from an engine manifold vacuum source to the decel throttle control kicker.	X	NA
b. Run engine at approximately 2500 rpm for 15-seconds, then release the throttle.	X	NA
c. If decel throttle control rpm is not within ± 50 rpm of specification, adjust the kicker. Refer to Figure 1.	X	NA
d. Disconnect the slave vacuum hose and allow engine to return to curb idle.	X	NA
5. Adjust curb idle, if necessary, using the curb idle adjusting screw with transmission in Neutral for manual and in Drive for automatic. Refer to Figure.	X 1	X 2
6. Rev the engine momentarily, recheck curb idle and adjust if necessary.	X	X
7. Reconnect the decel throttle control vacuum hose to the diaphragm.	X	NA
8. Check/adjust dashpot clearance by totally compressing the dashpot and adjusting for .100 inch clearance between collapsed dashpot and throttle lever at the closed throttle position.	NA	X
9. Reinstall the air cleaner.	X	X

Idle Speed Setting Procedures

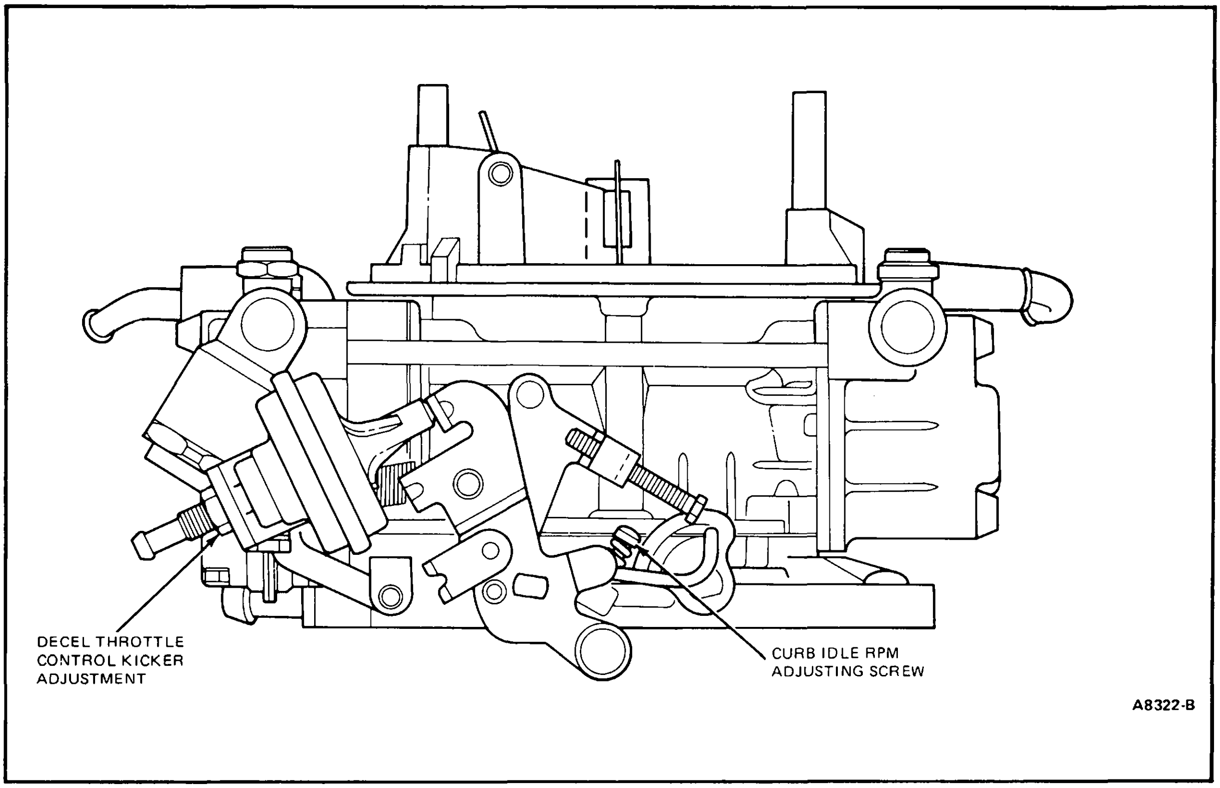

DECEL THROTTLE CONTROL KICKER ADJUSTMENT
CURB IDLE RPM ADJUSTING SCREW
A8322-B

Figure 1 7.5L Engine w/4180C-4V (Calibration and 4-98S-R11)—Decal Throttle Control Kicker and Curb Idle RPM

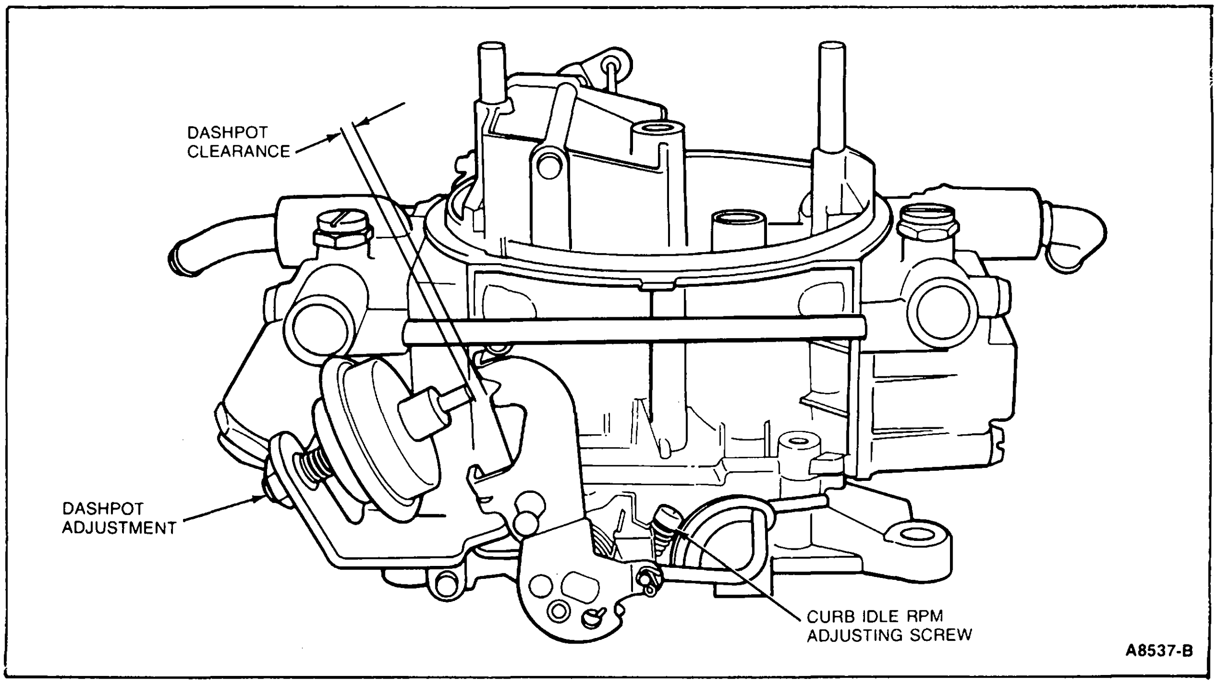


Figure 2 7.5L Engine w/4180C-4V (Calibration 5-97J-R00 and 5-98J-R00) — Curb Idle and Dashpot Adjustments

Idle Speed Setting Procedures

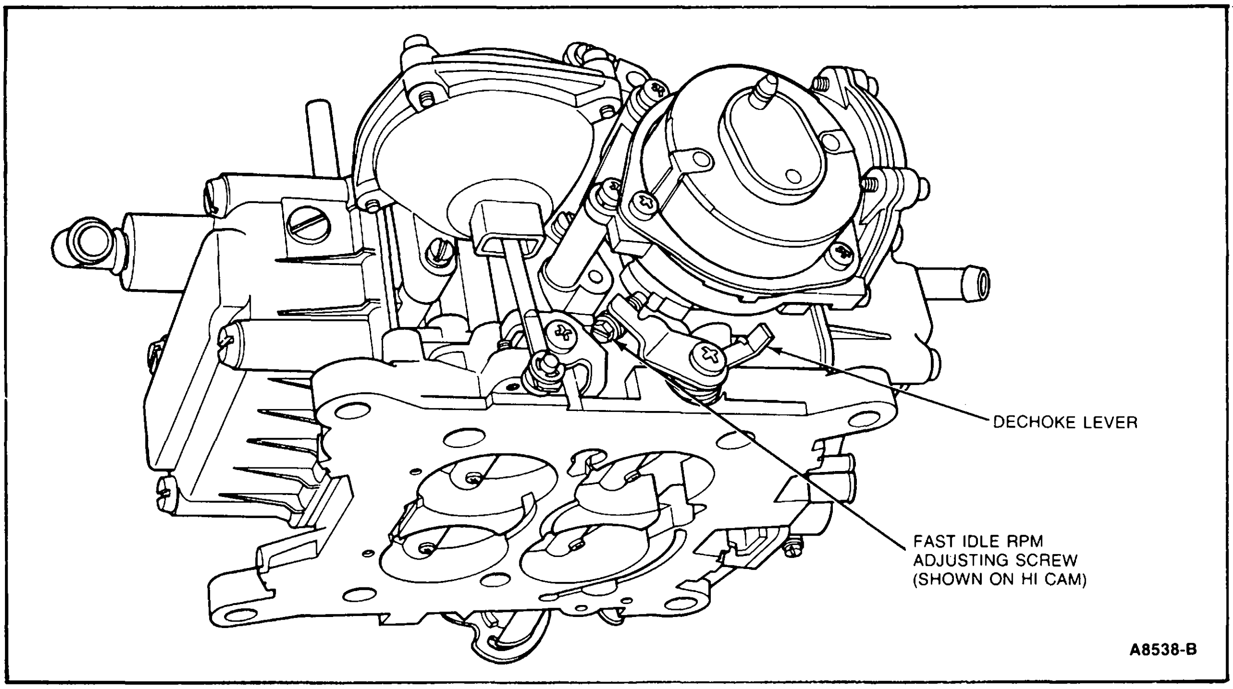


Figure 3 7.5L w/4180C-4V (Calibration 4-98S-R11, 5-97J-R00 and 5-98J-R00) — High Cam Position

Idle Speed Setting Procedures

TRUCK OVER 8500 GVW

7.5L Engine w/EFI

Instructions

Curb Idle Speed Check

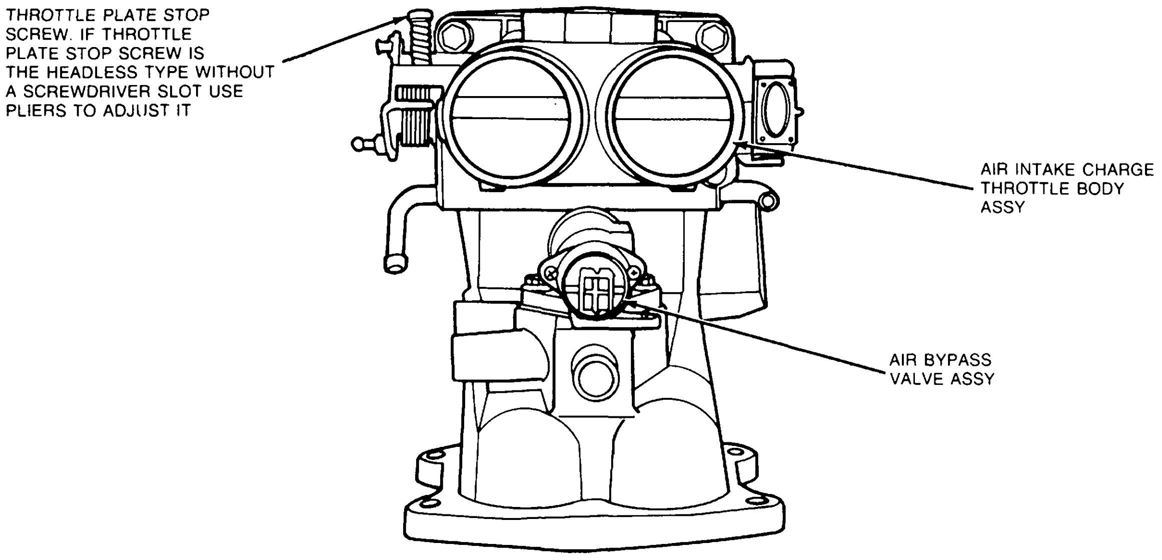
NOTE: Curb idle speed (RPM) is controlled by the EEC-IV processor and the idle speed control bypass air solenoid (ISC-BPA). If the control system is operating properly, these speeds are self-compensating and cannot be changed by traditional adjustment techniques.

Adjustments are sometimes required to establish the correct operating limits within which the ISC system can properly function. Misadjustment of the operating limits could restrict the operating range of the ISC system, so adjustments to the system should never be made unless a specific causal factor has been identified.

Before any idle speed adjustments are attempted the following procedure should be performed:

1. Set parking brake and block wheels. Bring the engine to normal operating temperature and turn Off. Place transmission in Neutral/Park. Turn the A/C-Heat selector to the Off position.
2. Verify that the throttle linkage is free, that travel is unobstructed and that the cruise control cable (is so equipped) is not holding the throttle open.
3. Check for vacuum leaks and repair as required.
4. Place transmission in Neutral and operate engine at 1800 rpm for at least 10 seconds.
5. Place transmission in Drive (A/T) or leave in Neutral (M/T). Allow engine to stabilize and check idle speed.
6. If curb idle speed is equal to or less than 700 rpm (A/T) 750 rpm (M/T) do not adjust.
7. If speeds exceed 700 rpm (A/T) or 750 (M/T) turn engine Off and disconnect the negative (-) terminal of the battery for 5 minutes and then reconnect. Repeat Steps 4, 5 and 6.
8. If speeds exceed specification, perform EEC-IV Quick Test, Section 18 and resolve any vehicle defects that are indicated by service output code; then repeat Steps 4, 5 and 6.
9. If speeds still exceed 700 rpm (A/T) or 750 rpm (M/T), disconnect the wire from the air bypass valve assembly. Back out throttle plate screw (Figure 1) until the idle speed reaches 650 ± 20 rpm (A/T) or (M/T) then reconnect the wire to the air bypass valve assembly.

Idle Speed Setting Procedures


THROTTLE PLATE STOP SCREW. IF THROTTLE PLATE STOP SCREW IS THE HEADLESS TYPE WITHOUT A SCREWDRIVER SLOT USE PLIERS TO ADJUST IT
AIR INTAKE CHARGE THROTTLE BODY ASSY
AIR BYPASS VALVE ASSY

A9965-A

Figure 1 7.5L EFI

Idle Mixture Setting Procedures

IDLE FUEL MIXTURE—PROPANE ENRICHMENT METHOD

Propane Enrichment Procedures Are Not Applicable For The Following:

- CFI Applications.
- EFI Applications.
- Truck Over 8500 GVW Applications.
- 5.8L MCU Police and Trailer Tow Vehicles w/7200 Carburetors.

Idle Mixture Setting Procedures

IDLE FUEL MIXTURE—PROPANE ENRICHMENT METHOD

Passenger Car. 2.3L HSC w/1949-IV

Truck, Under 8500 GVW: 5.8L w/4180C-4V.

NOTE: This procedure is applicable to the above engines only. If CO and HC are not within specification, perform appropriate electrical diagnostic procedure in Section 15.

I. Vehicle Preparation: All Carburetors as noted above.

A. Apply the parking brake, and block the wheels. Disconnect the automatic brake release, if so equipped, and plug the vacuum connection.

B. Connect tachometer, Rotunda Model 059-00001, 099-00001 or equivalent.

C. If so equipped, ensure that the hot idle compensator is in a closed position and remains so throughout the test. Idle vehicle on kickdown step of fast idle cam for three to five minutes to ensure that HIC valve is closed.

D. If so equipped, disconnect the fuel evaporative purge hose at the engine or the carburetor, (1.9L engines) and plug the connection. (Not applicable to 5.8L Truck engines).

E. If so equipped, disconnect the fuel evaporative purge hose at the air cleaner and plug the nipple. (Not applicable 5.8L Truck engines.)

F. Disconnect the flexible fresh air tube from the air cleaner duct or adaptor. Using propane enrichment Tool T75L-9600-A or equivalent, insert the tool hose approximately 3/4 of the way into the duct or fresh air tube. If necessary, secure the hose with tape.

G. For vehicles equipped with Thermactor systems, revise the dump valve vacuum hoses as follows:

1. For dump valves with two vacuum fittings, disconnect and plug the hose(s).
2. For dump valves with one fitting or combination air bypass/air control valve, remove the hose at the dump valve and plug it. Connect a slave hose from the dump valve vacuum fitting to an intake manifold vacuum fitting. (Not applicable to 5.0L and 5.8L Truck engines with 2150A-2VFB).
3. For 5.8L 418OC-4V Truck Disconnect and Plug Vacuum Hose to Dump Valve.

H. When the above Steps have been completed, proceed to Section II.

Refer to TSB **89-12A-26** for **REVISED REFERENCE TO TACHOMETER IN PROCEDURE I.-B**

Idle Mixture Setting Procedures

II. Propane Enrichment Method (Except as Noted)

NOTE: Leave all vacuum signal hoses attached to the air cleaner assembly when relocating the assembly to perform carburetor adjustments. The air cleaner assembly must be in place, however, when measuring engine speeds.

CAUTION: Prolonged engine idling can result in catalyst overheating and excessive underbody temperatures.

A. Verify that the timing is set to specification; reset if necessary, Section 15.

B. Check engine curb idle rpm or A/C-off rpm, and, if necessary, reset to specification, Section 4.

NOTE: Even if the vehicle has less than 160.9 km (100 miles) of operation, set the speed to the normal engine specification.

NOTE: Remove PCV valve from grommet, and allow PCV valve to draw underhood air during idle fuel mixture check. (PCV should remain in vertical position).

Locate the crankcase vent hose and disconnect at the air cleaner end, allowing the hose to vent to underhood air during idle fuel/air mixture check.

C. With the transmission in Neutral, run the engine at approximately 2500 rpm for 15 seconds before each mixture check.

NOTE: On Tempo/Topaz, run engine until electric fan comes On.

D. With the engine idling at normal operating temperature, place the transmission selector in the position specified for the idle fuel mixture check. **Gradually** open the propane tool valve, and watch for engine speed gain, if any, on the tachometer. When the engine speed reaches a maximum and then begins to drop off, note the amount of speed gain. The propane cartridge must be in vertical position.

NOTE: On Tempo/Topaz, check propane speed gain with engine cooling fan running.

NOTE: If the engine speed will not drop off, check the propane cartridge gas supply. If necessary, repeat Steps C and D with a new propane cartridge gas supply.

E. Compare measured speed gain to specified gain.*

1. If the measured speed gain is within specification, proceed to Step G.

   NOTE: If the carburetor assembly is equipped with a tamper-resistant idle adjustment feature, the carburetor must be removed from the vehicle. Refer to Shop Manual, Group 24 for removal of the above feature.

   NOTE: If it is determined that idle fuel mixture adjustment will be necessary, adjust the mixture according to the reset rpm specification.

Idle Mixture Setting Procedures

NOTE: If the measured speed gain is "0" rpm (no rpm rise) and the minimum speed gain specification is "0" rpm, proceed to Step 4.

2. If the measured speed gain is higher than the speed gain specification:*

   Turn the mixture screw(s) counterclockwise (rich) in equal amounts while simultaneously repeating Steps B, C, and D until the measured speed rise meets the reset rpm specification. *After final adjustment, proceed to Step F.

3. If the measured speed gain is **lower** than the speed gain specification.*

   Turn the mixture screw(s) counterclockwise (rich) in equal amounts while simultaneously repeating Steps B, C and D until the measured speed rise meets the reset rpm specification. * After final adjustment, proceed to Step F.

   After final adjustment, proceed to Step F.

4. If there is no rpm rise and the **minimum** speed gain specification is "0" rpm, perform the following speed drop test:

   NOTE: Speed drop test information is specified with the artificial enrichment requirements whenever the minimum speed gain specification is "0" rpm.*

   a. While watching the tachometer, adjust the mixture screw(s) clockwise (lean) by the number of turns specified for the speed drop test. Note the drop in engine speed.

   b. If the measured speed drop is equal to or drops off by more than (including stall) the speed drop specification, return the mixture screw(s) to the position before adjustment. Proceed to Step F.

   c. If the measured speed drop is less than the specified minimum speed drop specification, leave the mixture screw(s) in the adjusted position and repeat Steps B through E.

F. Reinstall the carburetor idle fuel air adjustment tamper-resistant features. Refer to Group 24.

G. Reinstall PCV valve in grommet, and readjust curb idle to green engine idle specification if applicable.

H. Remove all test equipment. Reconnect all system components, reinstall air cleaner, then tighten the air cleaner wing nut(s) to specification.

III. Removal and Installation for Tamper-Resistant Fuel Air Adjustment Feature:

A. See appropriate carburetor disassembly instructions in Shop Manual, Group 24.

*Refer to the Special Specifications Issue TSB Publications.

Idle Mixture Setting Procedures

IDLE FUEL MIXTURE—PROPANE ENRICHMENT METHOD

2.0L TRUCK UNDER 8500 GVW w/Aisan Carburetor

NOTE: This procedure is for 2.0L Truck engines only, it is not for trucks over 8500 GVW. Propane specifications are not listed for these applications. If CO and HC are not within specification, perform appropriate electrical diagnostic procedure, Section 15.

I. Vehicle Preparation

A. Apply the parking brake and block the wheels.

B. Connect a tachometer, Rotunda Model 059-00001, 099-00001 or equivalent.

C. Disconnect the flexible fresh air tube from the air cleaner duct or adaptor. Using propane enrichment Tool T75L-9600-A or equivalent, insert the tool hose approximately 3/4 of the way into the duct or fresh air tube. If necessary, secure the hose with tape.

D. Disconnect and plug the hose at the air bypass valve.

E. Disconnect and plug the hose between the purge valve and the spacer at the purge valve.

F. When the above Steps have been completed, proceed to Section II.

II. Propane Enrichment Method (Except as Noted)

NOTE: Leave all vacuum signal hoses attached to the air cleaner assembly when relocating the assembly to perform carburetor adjustments. The air cleaner assembly must be in place, however, when measuring engine speeds.

CAUTION: Prolonged engine idling can result in catalyst overheating and excessive underbody temperatures.

A. Verify engine timing is set to specification—reset if necessary, Section 15.

B. Verify that the curb idle speed is being controlled to specification. Then, electrically disconnect idle speed control (ISC) motor from wiring harness.

C. Place A/C-heat selector in the Off position and verify that lamps are Off.

NOTE: Remove PCV valve from grommet, locate the crankcase closure hose and disconnect at the air cleaner end (allowing the PCV valve and closure hose to vent to underhood air during idle fuel mixture check).

D. With the transmission in Neutral, run the engine at approximately 2500 rpm for 15 seconds before each mixture check. If check is not completed within 60 seconds, repeat this cleanout Step.

Refer to TSB 89-12A-26 for REVISED REFERENCE TO
TACHOMETER IN PROCEDURE I.-B

Idle Mixture Setting Procedures

E. With the engine idling at normal operating temperature **gradually** open the propane tool valve and watch for engine speed gain, on the tachometer. When the engine speed reaches a maximum and then begins to drop off, note the amount of speed gain. (Propane cartridge must be in vertical position).

NOTE: If the engine speed will not drop off check the propane cartridge gas supply. If necessary repeat Steps D & E with a new propane cartridge gas supply.

F. Compare measured speed gain to specified speed gain.*

1. If the measured speed gain is within specification, proceed to Step H.

   NOTE: The carburetor assembly is equipped with a tamper-resistant idle adjustment feature, the carburetor must be removed from the vehicle. Refer to Shop Manual, Group 24 for removal of the above feature.

   NOTE: If it is determined that idle fuel mixture adjustment will be necessary, adjust the mixture according to the reset rpm specification.

2. If the measured speed gain is higher than the speed gain specification:*

   Turn the mixture screw counterclockwise (rich) and simultaneously repeat Steps D and E until the measured speed rise meets the reset rpm specification.* After final adjustment, proceed to Step G.

3. If the measured speed gain is lower than the speed gain specification:*

   Turn the mixture screw clockwise (lean) and simultaneously repeat Steps D and E until the measured speed rise meets the reset rpm specification.* After final adjustment, proceed to Step G.

4. If there is no rpm rise and the minimum speed gain specification is "0" rpm, perform the following speed drop test:

   NOTE: Speed drop test information is specified with the artificial enrichment requirements whenever the minimum speed gain specification is "0" rpm.*

   a. While watching the tachometer, adjust the mixture screw ¼ turn clockwise (lean). Note the drop in engine speed.

   b. If the measured speed drop is greater than "0" and less than or equal to 40 rpm, proceed to Step G.

   c. If the measured speed drop is more than 40 rpm, return the mixture screw to the position before adjustment. Proceed to Step G.

   d. If the measured speed drop is still "0" rpm repeat steps a, b, and c.

G. The carburetor fuel air adjustment must have the tamper-resistant feature reinstalled, see Section III.

*Refer to the Special Specifications Issue TSB Publications.

Idle Mixture Setting Procedures

H. Reinstall PCV valve in grommet. Reconnect air bypass valve, purge valve and crankcase closure hose. Reconnect ISC motor to wiring harness.

I. Remove all test equipment. Reconnect all system components, reinstall air cleaner, and tighten the air cleaner wing nut(s) to specification.

III. Removal and Installation for Tamper-Resistant Fuel Air Adjustment Feature:

A. See appropriate carburetor disassembly instructions in Shop Manual, Group 24.

Choke Adjustment Procedure

PASSENGER CAR — CANADA

AUTOMATIC CHOKE SYSTEM—2.3L HSC ENGINE w/HOLLEY 1949-IV

I. Pre-Check Instructions

A. Apply parking brake, and block the wheels.

B. Start the engine, bring to normal operating temperature, and turn Off.

C. Remove the air cleaner assembly, then plug the vacuum hose(s) disconnected from the air cleaner.

II. Freedom of Linkage and System Integrity Check

A. Verify that pertinent vacuum hoses, solenoid, and electric choke wires are properly connected and intact; correct as required.

B. Check all carburetor linkages for freedom of operation as follows: Manually depress the throttle lever to 1/4 open position, and rotate the choke plate to the closed position. Release the choke plate; the choke plate should rotate smoothly to the open position. If sticking or binding is exhibited, clean/service/replace/adjust the choke linkage as required, to restore freedom of choke plate movement. If necessary, bring engine to normal operating temperature to check linkage freedom.

III. Electric Choke Functional Test

A. Choke Circuit Test

1. Disconnect the choke lead at the choke and connect a test lamp in series with the choke lead wire and ground. With the engine running, if the lamp glows, proceed to Step B.

2. If the lamp does not glow, perform the following test:

   Alternator Stator Center Tap

   a. If the lamp does not glow, bypass the stator lead wire and connect the test lamp in series with the alternator stator terminal and ground. If the lamp glows, service or replace the stator lead wire. If the lamp does not glow, service the alternator as required.

   b. Stop the engine. Remove the test lamp. Reinstall the stator lead wire.

   c. Repeat choke circuit test (previously replaced components could be faulty).

   d. Stop the engine. Remove the test lamp. Reinstall the choke lead wire.

Choke Adjustment Procedure

B. Cap Continuity Test

1. With the engine Off and the air cleaner removed, connect one lead of the test lamp to the choke cap lead, then touch the other lead to the positive post of the battery. If the lamp glows, there is continuity. Remove the test lamp and leads.
2. If the test lamp does not glow, attach a jumper lead between the choke cap ground strap (Figure 2) and the carburetor body.
3. If the test lamp glows, service contact between choke cap ground strap and carburetor body. Repeat Step 1.
4. If the test lamp does not glow, replace the choke cap. Refer to Shop Manual, Group 24, then repeat Step 1.
5. Reinstall the choke lead wire to vehicle harness.

C. Choke Time-To-Rotate Test

1. Set the fast idle adjustment screw on the highest step of the fast idle cam.
2. Cool the choke housing externally following the choke tester manufacturer's instructions, except as follows:
   a. Refer to the Special Specifications Issue TSB Publications for choke come-off time specification.
   b. Turn off choke tester momentarily at 1 minute intervals until the bimetal closes and seats the choke plate lightly in the air horn.
3. Start the engine, and set the fast idle adjustment screw on kickdown by depressing the throttle once. Measure choke plate rotation time from the point of starting the engine until choke plate is in vertical position.
4. If the choke come-off time does not meet specification, replace the choke cap. Refer to Shop Manual, Group 24, then repeat Steps 1, 2, and 3.

IV. Choke Pulldown Vacuum Circuit

A. Remove the vacuum line to the choke pulldown motor at the tube on the carburetor body (Figure 3) and apply an external vacuum source of 50.5-67 kPa (15-20 in.-Hg.) to the free end of the pulldown motor vacuum hose.

1. If the pulldown motor activates, proceed to Step B.
2. If the pulldown motor does not activate, temporarily seal end of adjustment screw boss and apply external vacuum source again.
3. If pulldown motor activates, seal end of adjustment screw boss with Black Silastic 732 and proceed to Step B.
4. If pulldown motor does not activate, remove the pulldown motor vacuum hose from the pulldown motor and apply external vacuum source directly to pulldown motor, while temporarily sealing end of adjustment screw boss.

Choke Adjustment Procedure

5. If pulldown motor activates, replace pulldown motor vacuum hose.

6. If pulldown motor does not activate, replace the pulldown motor. Refer to Shop Manual, Group 24, then repeat Steps 1, 2, and 3.

B. Apply an external vacuum source to the pulldown vacuum supply tube on the carburetor body.

1. If vacuum holds, clean pulldown vacuum supply tube and port on carburetor body as required. Repeat Step B.

2. If vacuum does not hold, proceed to Section V.

V. Carburetor Choke Adjustments

A. Choke plate pulldown

NOTE: If choke plate pulldown is adjusted, fast idle cam idex check (Section V, Step B) (Figure 3) must be performed.

1. Cool the choke housing externally following the choke tester manufacturer's instructions, except as follows:

   Turn-off choke tester momentarily at 1 minute intervals until the bimetal closes and seats the choke plate lightly in the air horn.

2. Activate the pulldown motor by applying an external vacuum source of 50.5-67 kPa (15-20 in.-Hg.) to free end of pulldown motor vacuum hose.

3. Apply light pressure to the upstream edge of the choke plate in the closing direction to remove clearance between pulldown motor clevis and modulator stem (Figure 1).

4. Using a drill of the specified size, measure the clearance between the upper edge of the choke plate and the air horn wall (ensure that drill is held vertical—parallel to air horn wall). Refer to the Special Specifications Issue TSB Publications for specifications.

5. If an adjustment is required, perform the following procedure:

   a. Remove carburetor from engine.

   b. Drill a 1/16-inch diameter hole through the pulldown motor adjustment screw lead seal plug (original pulldown motors only) (Figure 1).

   c. Insert an Easy-Out tool and remove plug.

   d. Apply Black Silastic 735 to end of adjustment screw boss, then apply external vacuum to pulldown motor before inserting allen wrench.

   e. Repeat Steps 2, 3, and 4. Turn the adjusting screw in or out as required.

Choke Adjustment Procedure

f. Install a new lead plug in adjusting screw access hole and stake while supporting the pulldown motor bracket (Figure 1). Check for the vacuum leak.

g. Install pulldown motor hose on pulldown vacuum supply tube on carburetor body.

h. Fast idle cam index check (Step B1 through B10 below) **must** be performed.

i. Install carburetor on engine.

B. Fast Idle Cam index setting

NOTE: Fast idle rpm and choke plate pulldown must be set before fast idle cam index is set.

1. Cool the choke housing externally following the choke tester manufacturer's instructions, except as follows:

   Turn off choke tester momentarily at 1 minute intervals until the bimetal closes and seats the choke plate lightly in the air horn.

2. Position fast idle screw on high step of fast idle cam.
3. Activate the pulldown motor by applying an external vacuum source of 50.5-67 kPa (15-20 in.-Hg.).
4. Apply light pressure to the upstream edge of the choke plate in the closing direction, to remove clearance between pulldown motor clevis and modulator stem (Figure 1).
5. Open the throttle slightly and allow fast idle cam to drop.
6. Close throttle and measure the clearance between top edge of fast idle rpm adjusting screw and shoulder of fast idle cam high step (Dimension A, Figure 2) fast idle cam index. Dimension A should be 0.51 to 0.76mm (0.20 to .030 inches).
7. Remove light closing pressure from upstream edge of choke plate.
8. Open throttle to WOT position and return slowly.
9. Fast idle adjustment screw must contact lower end of fast idle cam kickdown step by at least half of its diameter for carburetors with four step cams (Figure 4).
10. If Steps 6 and 9 are okay, fast idle cam index is within specification.
11. If an adjustment is required, perform the following:

    a. Repeat Steps 2 through 6, bending fast idle cam link at loop as required to obtain Dimension A, (Figure 1).

    b. Repeat Step 5 and 6 **again** to verify setting.

    c. Repeat Steps 7 through 9.

Choke Adjustment Procedure

C. De-Choke

1. Cool the choke housing externally following the choke tester manufacturer's instructions, except as follows:

   Turn off choke tester momentarily at 1 minute intervals until the bimetal closes and seats the choke plate lightly in the air horn.

2. Hold the throttle lever in the WOT position.

3. Using a drill of the specified size, check the clearance between the upper edge of the choke plate and the air horn wall.

4. To adjust, carefully bend the tang on the throttle lever as required (Figure 5). Refer to the Special Specifications Issue TSB Publications for specifications.

VI. Choke Cap and Pulldown Motor Removal and Installation

Refer to Shop Manual, Group 24.

VII. Post-Check Instructions

A. Remove all test equipment. Install the air cleaner, reconnect pertinent vacuum lines. Verify that air cleaner heat riser tube and fresh air pick-up connections are correct. Tighten air cleaner wing nut(s) to specification.

B. Remove plugs from the air bypass valve vacuum hoses and reconnect to the air bypass valve.

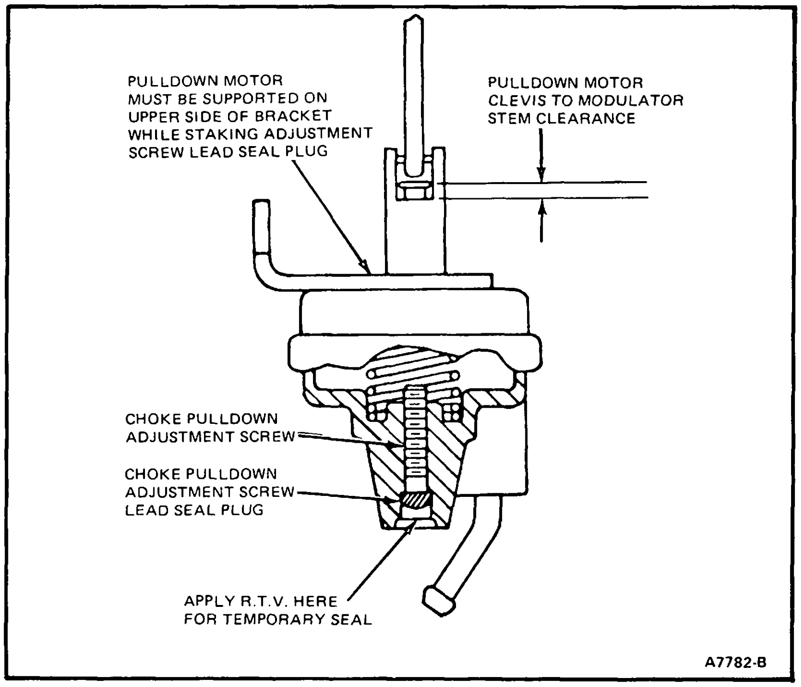

PULLDOWN MOTOR MUST BE SUPPORTED ON UPPER SIDE OF BRACKET WHILE STAKING ADJUSTMENT SCREW LEAD SEAL PLUG
PULLDOWN MOTOR CLEVIS TO MODULATOR STEM CLEARANCE
CHOKE PULLDOWN ADJUSTMENT SCREW
CHOKE PULLDOWN ADJUSTMENT SCREW LEAD SEAL PLUG
APPLY R.T.V. HERE FOR TEMPORARY SEAL
A7782-B

Figure 1 2.3L HSC 1949 2V Choke Pulldown Motor

Choke Adjustment Procedure

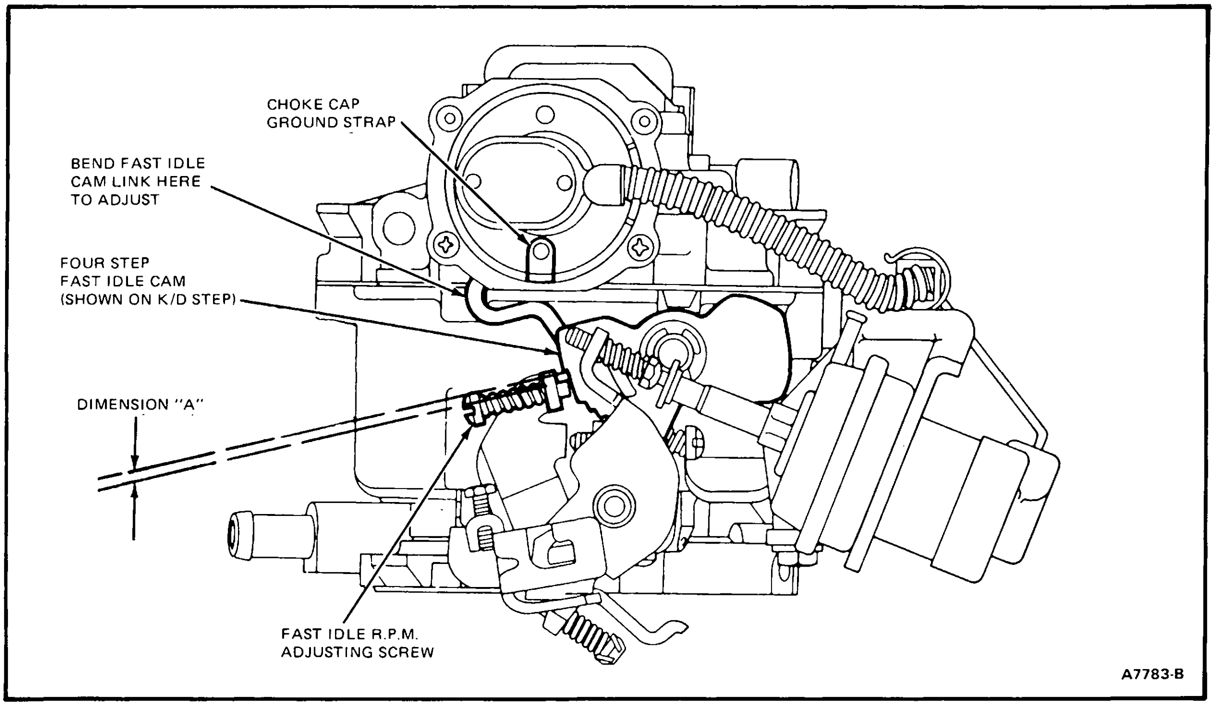

CHOKE CAP GROUND STRAP
BEND FAST IDLE CAM LINK HERE TO ADJUST
FOUR STEP FAST IDLE CAM (SHOWN ON K/D STEP)
DIMENSION "A"
FAST IDLE R.P.M. ADJUSTING SCREW
A7783-B

Figure 2 2.3L HSC with 1949 Choke Adjustment—Fast Idle Cam Index

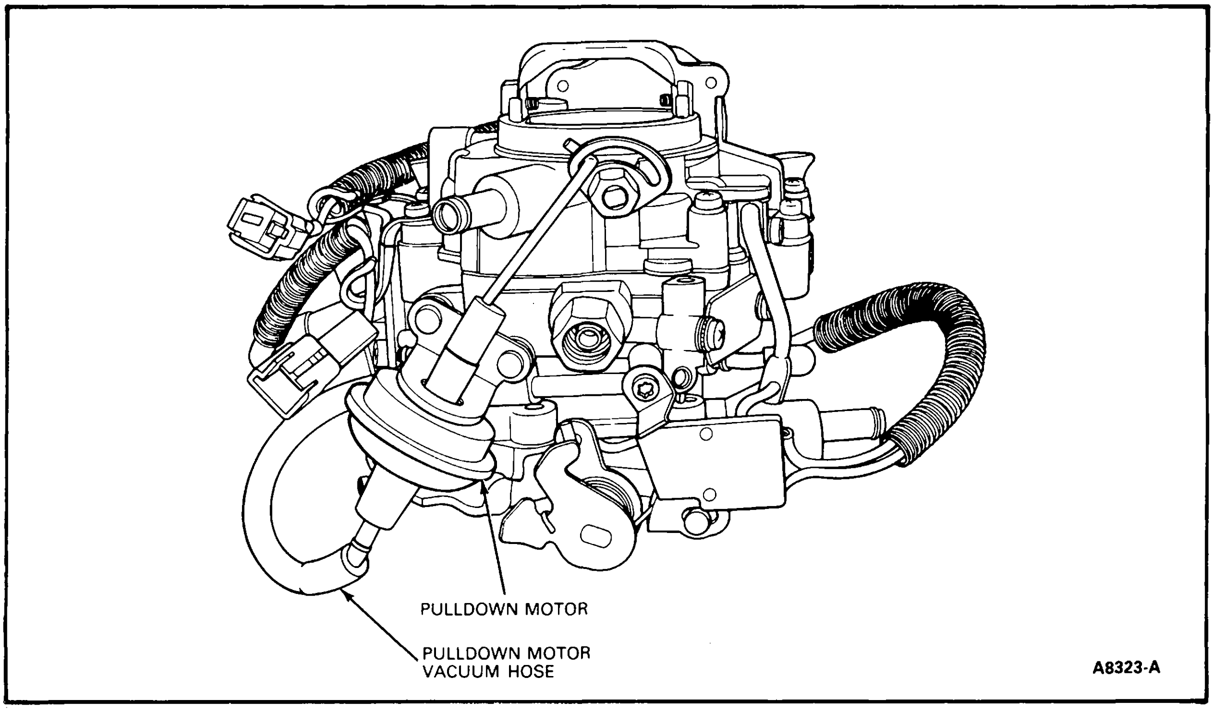


Figure 3 2.3L HSC 1949 Choke Adjustment—Choke Pulldown

Choke Adjustment Procedure

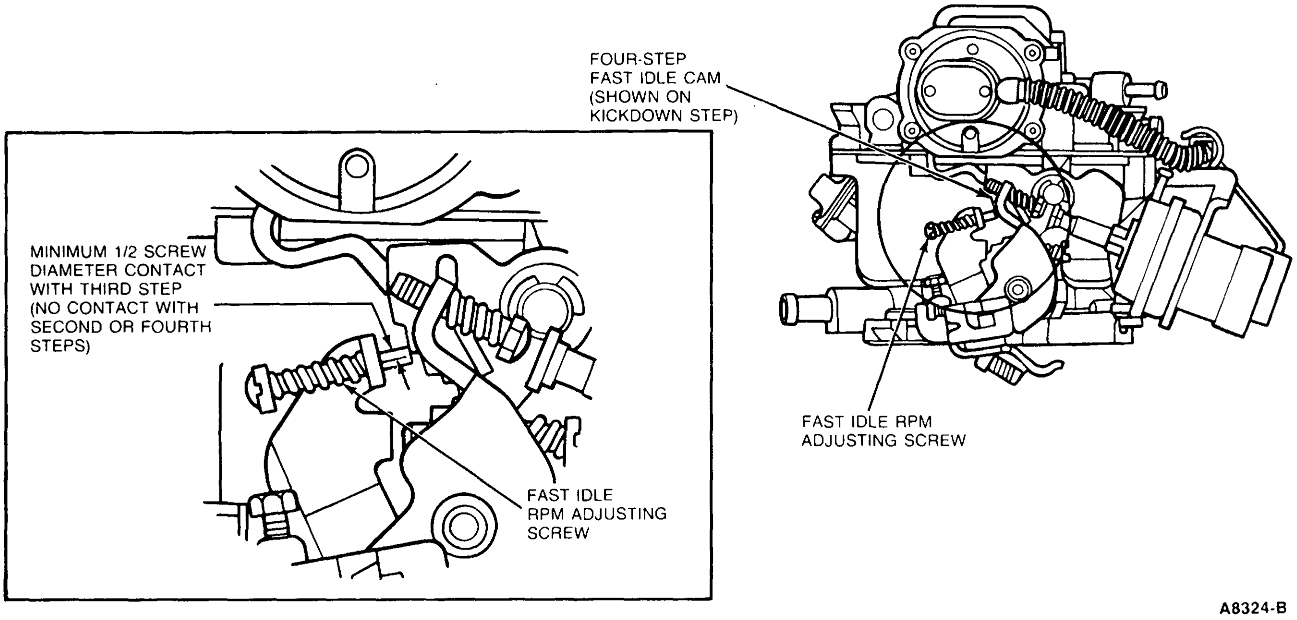

FOUR-STEP FAST IDLE CAM (SHOWN ON KICKDOWN STEP)
MINIMUM 1/2 SCREW DIAMETER CONTACT WITH THIRD STEP (NO CONTACT WITH SECOND OR FOURTH STEPS)
FAST IDLE RPM ADJUSTING SCREW
FAST IDLE RPM ADJUSTING SCREW
A8324-B

Figure 4 2.3L HSC 1949-IV—Fast Idle Cam Index Check—Four Step (Light Closing Pressure Removed from Choke Plate)

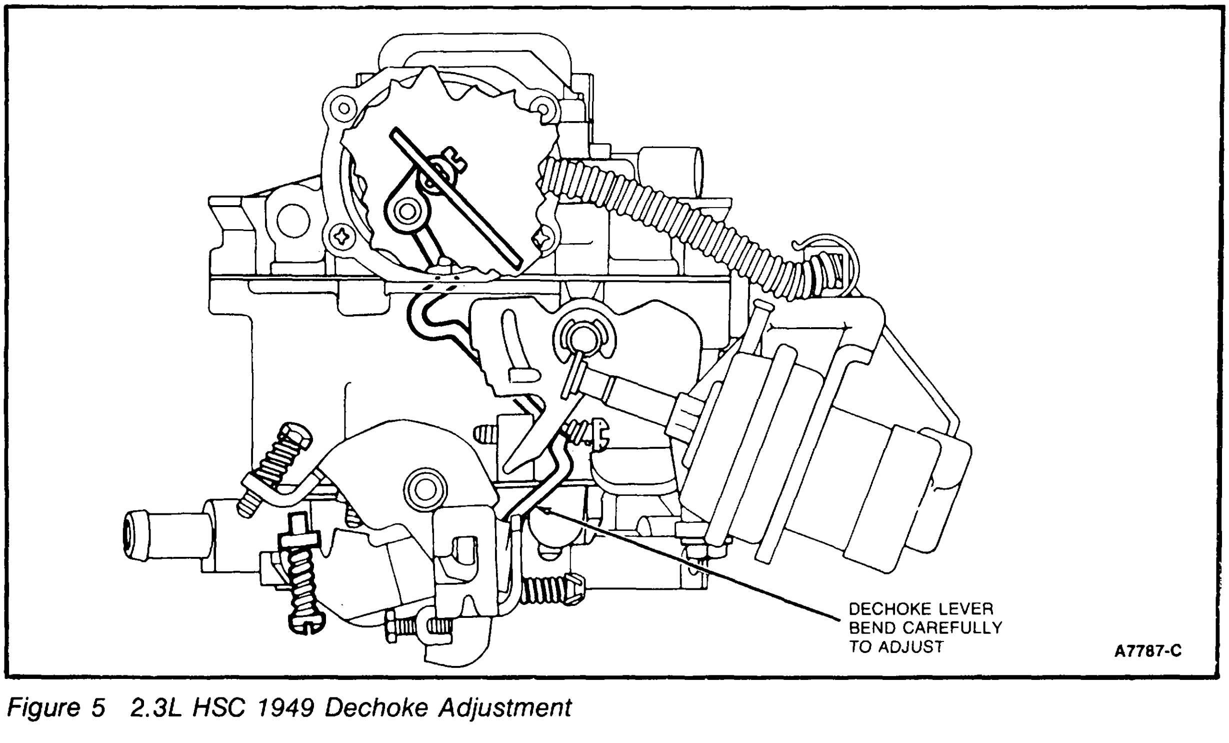


Figure 5 2.3L HSC 1949 Dechoke Adjustment

Choke Adjustment Procedure

TRUCK

AUTOMATIC CHOKE SYSTEM APPLICATION: 2.0L WITH AISAN CARBURETOR AND ALL-ELECTRIC CHOKE

I. Pre-Check Instructions

A. Apply parking brake, and block the wheels.

B. Start the engine, bring to normal operating temperature, and turn Off.

C. Remove the air cleaner assembly and plug the vacuum hose(s) to the air cleaner.

II. Freedom of Linkage and System Integrity Check

A. Verify that all vacuum hoses and solenoid wires are properly connected and intact; correct as required. Check torque of carburetor holddown nuts; retighten to specification, if necessary. Refer to the Special Specifications Issue TSB Publications.

B. Check all carburetor linkages for freedom of operation as follows:

1. Manually depress the throttle lever to ¼ open position, and rotate the choke plate to the closed position. Release the choke plate; the choke plate should rotate smoothly to the open position. If sticking or binding is exhibited, clean/service/replace/adjust the choke linkage, as required to restore freedom of choke plate movement. If necessary, bring engine to normal operating temperature and recheck linkage freedom.

III. Choke Functional Test

A. To set the choke on high cam, depress the throttle lever to the ½ open position, then push the choke plate completely closed. While holding the choke plate closed, release the throttle lever, then release the choke plate.

B. Cool the choke housing following the choke tester manufacturer's instructions, except as follows:

1. Do not use the manufacturer's choke come-off time specifications if supplied with tester kit.
2. Turn off choke tester or inlet valve momentarily at 15-second intervals until the bimetal closes the choke plate lightly in the air horn.

C. Move the fast idle cam to the kickdown step to avoid excessive engine speed. Choke plate should still be lightly closed in the air horn — recool if necessary. Without touching the throttle, start the engine. Measure the time required for the choke plate to rotate from closed position to full open against the stop.

1. Choke plate rotation time is measured from engine startup until the choke plate reaches the stop in the vertical position.

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2. Refer to the Special Specifications Issue TSB Publications for rotation time.
3. If the choke come-off times does not meet specification, allow the engine to return to curb idle speed. Turn the engine Off and proceed to Step E.
4. If the choke come-off time meets specification, allow the engine to return to curb idle speed. Turn engine Off and proceed to Step D.

NOTE: Do not go to Step E unless choke failed to function properly.

D. Choke Cap Resistance Test

With an ohmmeter, set to lowest range that will indicate 30-ohms (maximum). Connect one lead of an ohmmeter to choke cap terminal and the other lead to choke cap clamp. Ensure metal-to-metal contact is achieved (not metal-oxide film) and false readings are prevented. The ohm reading should be under 30 but never zero. If the ohm reading is outside this range, start the test all over. If this improper reading repeats, the choke cap is defective. The cap should be replaced per Group 24, Powertrain manual.

E. Choke Circuit Test

1. Do not perform this test unless choke failed Step C.
2. Disconnect the choke wire at the choke and connect a test lamp in series with the choke wire and ground. With the engine running, if the lamp glows, go to Step 3, if the lamp does not glow, service or replace the choke power relay circuit as required.
3. If the lamp glows in Step 2, check that the choke cap is grounded by connecting one end of a test lamp to the choke cap attaching ring and the other end to the positive terminal of the battery, if the lamp glows, replace the choke cap. If the lamp does not glow correct the poor choke cap grounding.
4. Stop the engine, remove the test lamp.

IV Carburetor Choke Adjustment

A. Two stage choke pulldown adjustment

Refer to Figure 1.

1. First stage

a. Set the choke on high cam by depressing the throttle lever to the ½ open position and then pushing the choke plate completely closed. While holding the choke plate closed, release the throttle lever, and then release the choke plate.

b. Activate the first stage pulldown by applying an external vacuum source (16 in.-Hg. minimum) to the first stage vacuum connection.

Choke Adjustment Procedure

c. Using a drill of the specified diameter check the clearance between the lower edge of the choke plate and the air horn wall while applying light finger pressure to the choke plate in the closing direction. Refer to the Special Specifications Issue TSB for specifications.

d. If required, adjust by bending the lever as shown in Figure 1. (NOTE: Choke cap must be removed per procedure in Shop Manual Section 24.)

2. Second Stage

a. **Continuing** with the above procedure, apply an external vacuum source (16 in.-Hg. minimum) to the Second Stage vacuum connection.

NOTE: The external vacuum source must **not** have been removed from the first stage. At this point in the procedure, vacuum is applied to **both** the first-and second-stage simultaneously.

b. Using a drill of the specified diameter, check the clearance between the lower edge of the choke plate and the air horn wall while applying light finger pressure to the choke plate in the closing direction. Refer to the Special Specifications Issue TSB for specification.

c. If required, adjust by turning the Second Stage adjustment screw as shown in Figure 1.

B. De-Choke

Refer to Figure 2.

1. Remove the air cleaner.
2. Hold the throttle plate fully open, and close the choke plate as far as possible without forcing it. Use a drill of the specified diameter to check the clearance between the lower edge of the choke plate and the air horn wall. Refer to the Special Specifications Issue TSB.
3. If the clearance is not within specifications, adjust by bending the tang on the throttle lever as shown in Figure 2.

C. Fast Idle Cam Index Setting

Refer to Figure 3.

1. Position the fast idle screw on the second step of the fast idle cam against the shoulder of the high step, refer to Figure 3.
2. Check the clearance between the lower edge of the choke plate and air horn wall using a drill of specified diameter, refer to the Special Specifications Issue TSB.
3. If required, adjust by bending the tang as shown in Figure 3.

Choke Adjustment Procedure

D. Fast Idle Cam Breaker Adjustment (FICB) Refer to Figure 3.

1. Fully retract the idle speed control motor electrically. Refer to the curb idle speed check/adjustment procedure.
2. Set the throttle on the Hi cam position.
3. Apply 18 in.-Hg. minimum to the FICB motor (Figure 3).
4. The fast idle lever should now be on Step 3 (low step), of the fast idle cam.
5. Adjust by bending the link.

V. Post-Check Instructions

Reinstall air cleaner assembly and reconnect pertinent vacuum lines. Tighten air cleaner holddown bolts to specification.

VI. Removal and Installation of Adjustment Limiting Choke Cap

Refer to appropriate carburetor disassembly instructions in Shop Manual, Group 24.

Choke Adjustment Procedure

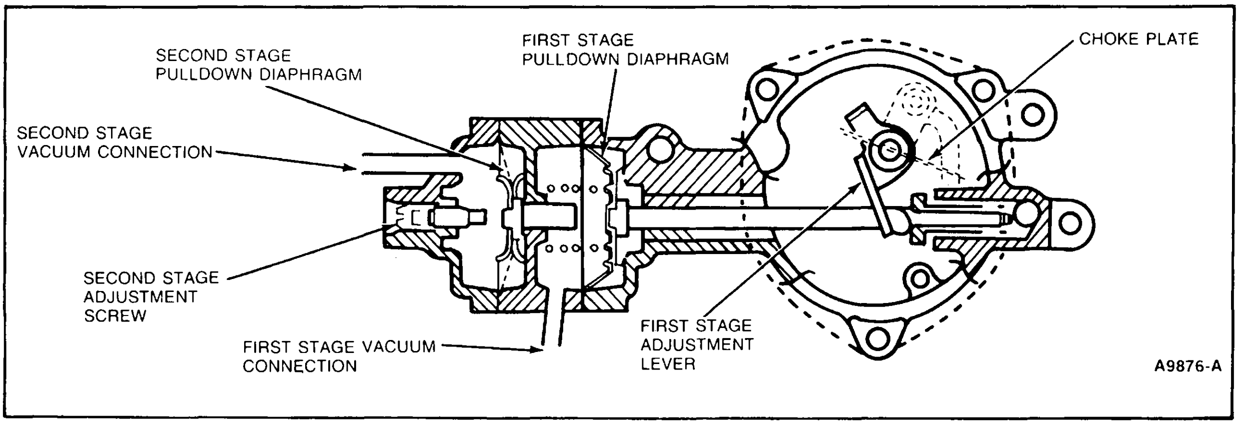

Figure 1 Choke Plate Pulldown—Two—Staged Type

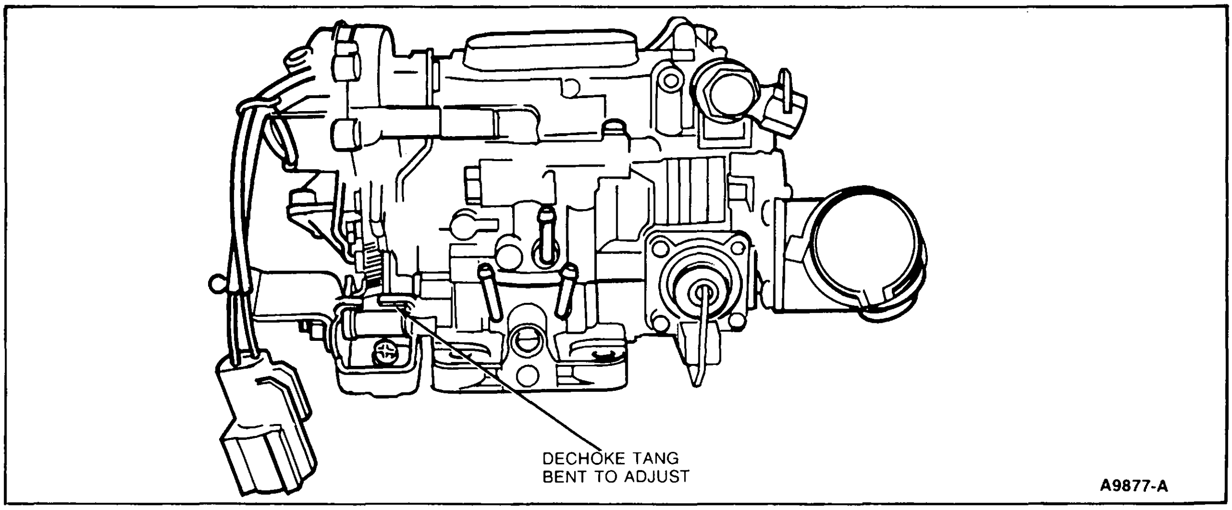

Figure 2 De-Choke

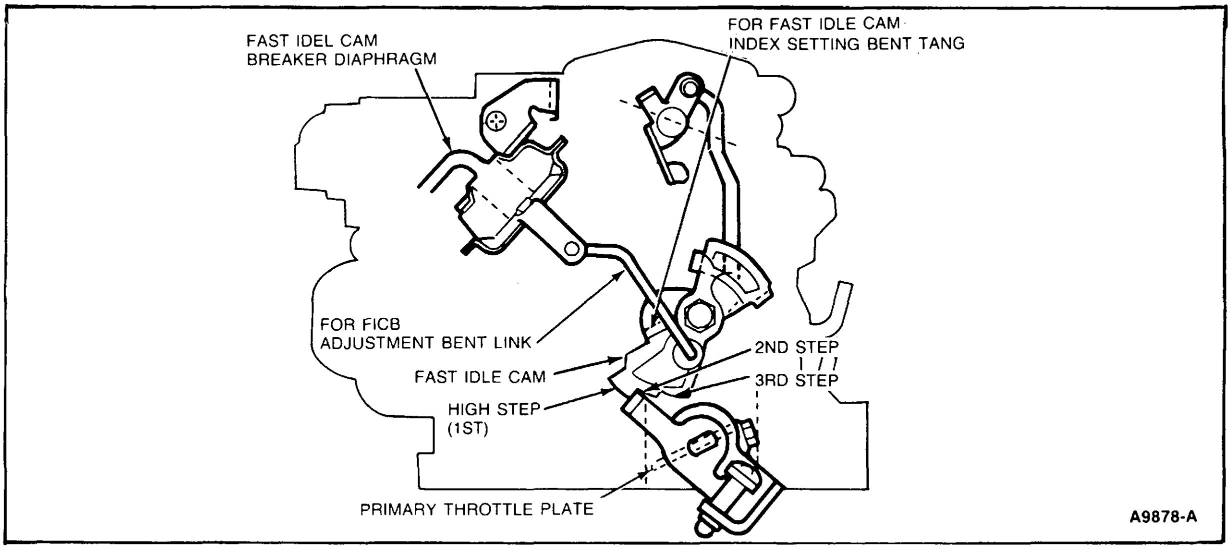

Figure 3 Fast Idle Cam Index Fast Idle Cam Breaker

Cold Enrichment System

PASSENGER CAR

COLD ENRICHMENT SYSTEM—MOTORCRAFT 7200-VV

I. Pre-Check Instructions

A. Apply parking brake, and block the wheels.

B. Remove the air cleaner assembly and plug the vacuum hose(s) leading to the air cleaner.

1. With the choke cap cool to the touch, turn the ignition key to the Run position **without** starting the engine for two minutes. The choke cap should not be warm to the touch.
2. Start up the engine if the cold enrichment rod is up when the fast idle cam is freed from the fast idle lever. Run the engine; do not exceed three minutes. The cold enrichment rod should seat. Turn the engine Off.

C. Manually set the fast idle lever on the specified step (refer to Engine Emission Decal) of the cam, counting the highest step as the first.

D. Start the engine and bring it to normal operating temperature.

E. Open the throttle and check to see if the cam freely falls to the full off position. If it is functioning properly, there should be a definite drop in engine speed when the throttle is released.

F. Turn Off the engine.

II. Freedom of Linkage and System Integrity Check

A. Verify that vacuum hoses, solenoid, and electric choke wires are properly connected and intact. Check to make sure all carburetor holddown nuts are tightened to specification. Correct as required.

B. Check all carburetor linkages for freedom of operation. If no binding exists, proceed to Section III. If binding exists, proceed to C.

C. Cold Enrichment Rod Mechanism Check

1. Check for damaged, foreign, missing, and/or misaligned parts. Check for dirt, grease, or any foreign material on moving parts. Service or replace as required. If linkage is serviced or replaced, check choke adjustments. Reset if necessary.
2. Remove the retaining E-ring that holds the choke control rod to the choke shaft lever, then disengage the linkage from the lever.
3. Open the throttle slightly and check the choke shaft lever for freedom of movement. The choke cap and the pulldown diaphragm return spring should provide the only resistance, and the choke shaft lever should spring back to the original position. Clean, service, or replace as required.

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4. To check if the carburetor has a sticking/binding CER perform the following procedure.
    a. Open the throttle to allow fast idle cam to move to "choke on" position.
    b. Hold the choke pulldown diaphragm in its retracted position.
    c. Push the CER down to its seated position, feel for any friction/binding.
    d. Release the CER, it should return to its original position automatically (room temperature or colder).
    e. Observe the upward movement of the CER for any indication of sticking/binding.
    f. Rotate the CER 90 degrees from its original position and repeat Steps b through e.

    NOTE: CER can be rotated using your fingers if the rod is placed in its full up position. The number identification on top of the CER can be used for the determining of the 90 degree rotation requirement.

    g. Rotate the CER another 90 degrees (total of 180 degrees from its original position) and repeat Steps b through e.
5. Verify if the carburetor has a sticking/binding CVR with the following procedure:
    a. Hold the choke pulldown diaphragm in its retracted position.
    b. Place the fast idle lever on the highest step of the fast idle cam.
    c. Push the CVR down to its seated position. Feel for any friction/binding.
    d. Release the CVR, 70°F or warmer, the CVR should lift-off its seat automatically, colder than 70°F, push down on the CER to lift the CVR.
    e. Observe the upward movement of the CVR for any indication of sticking/binding.
6. If cam movement is still not free, remove carburetor from vehicle, then remove the throttle body from the carburetor. Remove the choke cap, the choke shaft and lever assembly, and the fast idle cam. Check the surfaces of all parts for grease, foreign material, bends, cracks, or distortion. Clean or replace parts as required. If a new fast idle cam is installed, adjust cam set per procedure in Section V, and tighten to specification.
7. If movement is okay, make sure the choke control rod is connected to the choke shaft lever with the retaining E-ring. If the "CVR" causes binding, replace and reset, per Section V and Shop Manual, Group 24.
8. Reinstall the carburetor, per Section VI.

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III. Electrtic Choke Functional Test

A. Choke Circuit Test

NOTE: Refer to body wiring diagrams for detail information on electrical circuitry affected in this test. Two different types of circuitry are used. For battery powered choke, the choke cap and the oil pressure switch are connected in series through the wiring harness connectors.

For alternator powered choke, the choke cap wire is connected to the alternator stator terminal connection.

Either type is readily identifiable by visually tracing the routing from the choke cap terminal.

To perform continuity tests of Section III Steps A-1 and -2, listed below, disconnect the stator terminal of the alternator for alternator powered choke. Reconnect after completion of testing.

1. Choke Cap Continuity
   a. Turn ignition switch Off.
   b. Connect one end of a test lamp to the positive terminal of the battery and the other end to the choke cap terminal. The test lamp should light, indicating continuity. If it does light proceed to Step 2, if it does **not** light continue with Step c.
   c. Connect one end of a jumper wire to the choke cap clamp shroud and the other end to the negative terminal of the battery. Also connect one lead of a test lamp to the positive terminal of the battery and the other lead to the choke cap terminal.
   d. The test lamp should light indicating continuity; if not, connect the jumper wire directly to the choke cap ground; if the lamp lights, correct the poor contact between the choke cap clamp shroud and the choke cap ground. If the lamp does not light, replace the choke cap.
2. Continuity of all other circuit components, battery powered choke.
   a. Turn engine and ignition switch Off.
   b. Disconnect oil pressure switch from harness, use a jumper wire in place of the switch to complete the circuit.
   c. Connect one lead of a test lamp to the negative terminal of the battery and the other lead to the choke cap terminal.
   d. Turn the ignition key to the Run position without starting the engine. The lamp should be lit. If not, locate and service the open circuit by checking fuse, fuse link, connector, etc.
   e. Remove the jumper wire used as a substitute for the oil pressure switch; reconnect the harness lead wire to the oil switch terminal.
   f. Turn the ignition switch to the Run position without starting the engine. The test lamp should not indicate continuity. If the lamp indicates continuity, the oil pressure switch is defective.

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g. Start the engine. The test lamp should indicate continuity. If the lamp does not indicate continuity, the oil pressure switch is defective.

3. Continuity of all other circuit components, alternator powered choke:

    a. Connect one lead of a test lamp to the choke cap ground and the other lead to the negative terminal of the battery.

    b. Start the engine, the test lamp should indicate continuity. If not, locate and service open circuit between choke cap to alternator stator terminal. If no open circuit is found, check alternator output and service as required.

B. Choke Control Diaphragm Check

1. Check for bending, misaligned linkage, broken parts, contamination and/or loose parts, service as required.

NOTE: There are three different vacuum systems used; they are as follows:

    a. **Internally Ported:** there is no vacuum connector tube provided on the control diaphragm cover; the vacuum passage is internal to the casting.

    b. **Externally Ported, No Vacuum Trap:** a vacuum connector tube is provided on the diaphragm cover, and the vacuum line runs directly from this tube to the manifold vacuum tap.

    c. **Externally Ported With Vacuum Trap:** same as above but there is a vacuum trap in the line between diaphragm cover and manifold vacuum tap.

The method of testing is different for each system.

2. Running Engine Test

Start the engine and watch for the choke diaphragm rod to retract. If the retraction timing is within specification, listed in Special Specifications Issue TSB Publications, the choke control diaphragm is functioning properly and no further check is necessary. To perform the above for the Externally Ported With Vacuum Trap type vacuum system when the underhood temperature is 35°C (95°F) and above, bypass the vacuum trap (convert the system to Externally Ported, No Vacuum Trap type) first. Restore the original routing after completion of testing.

If the timing is out of specification or there is no retraction, the check must be continued. For Externally Ported, No Vacuum Trap or Externally Ported With Vacuum Trap, continue the check with Step 3 in the following. For the Internally Ported type, continue the check with Step 4 and the following:

3. Diaphragm Inspection, Cover Removed.

    a. Remove the diaphragm cover and the diaphragm per Shop Manual, Group 24 (removal of the carburetor is not necessary, but helpful).

    b. Visually inspect the diaphragm. If cut or torn, replace the diaphragm with a new one and assemble it with the original cover on the carburetor and continue with Step C.

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If the diaphragm is not cut or torn, replace the cover with a new one and assemble it with the original diaphragm on the carburetor and continue with Step C. Ensure the assembly is sufficiently tight to prevent vacuum bleed-off at diaphragm mounting.

c. Connect a vacuum line from the connector tube on the diaphragm cover to a powered vacuum source. Apply 60 kPa (18 In-Hg.) vacuum to the diaphragm and proceed with one of the following substeps, depending upon how the carburetor reacts to the vacuum:

   1. It retracts the diaphragm within the specification timing. No further check is necessary since the control diaphragm is functioning properly. Adjust any CER setting affected by component replacement per Section V, Step B.
   2. It does not retract the diaphragm within specification or it does not retract at all. Replace the cover with a new part, assemble* it with the existing diaphragm onto the carburetor, and repeat this test again. Be sure the assembly is sufficiently tight to prevent vacuum bleed-off at diaphragm mounting.

4. Diaphragm Inspection and Vacuum Passage Inspection.

a. Remove the carburetor and place it on a workstand. Remove the diaphragm and the cover per Shop Manual, Group 24.

b. Using compressed air or vacuum, check and remove any restriction in the vacuum passage, internal to the carburetor throttle body. Note that the choke air passage connects to the diaphragm vacuum passage in the casting.

c. Visually inspect the diaphragm. If the diaphragm is cut or torn, replace it with a new part and assembly with the original cover to the carburetor. Ensure the assembly is sufficiently tight to prevent vacuum bleed-off at diaphragm mounting site.

d. Connect a vacuum line from the port at the bottom of the casting to a powered vacuum source. Be sure to seal the junction at the casting properly to prevent bleed-off. Block the choke air inlet by capping the connector tube on the casting at a location right beneath the diaphragm cover. Apply 60 kPa (18 in.-Hg.) to the diaphragm and proceed with one of the following sub steps, depending upon how the carburetor reacts to the vacuum:

   1. It retracts the diaphragm within the specification timing. Go to Step e.
   2. It holds the vacuum but does not retract the diaphragm within specification or does not retract at all. Go to Step f.
   3. It does not hold vacuum; hence, no retraction. Go to Step g for casting leak check. Repeat of Step g is not necessary. If the carburetor still does not hold the vacuum after Step g was performed, go to Step f.

e. No further check is necessary since the control diaphragm is functioning properly. Adjust any CER setting affected by component replacement per Section V, Step B. Reinstall the carburetor and perform checks per Section VI.

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f. Replace the cover with a new one and assemble it with the existing diaphragm onto the carburetor and repeat Step d. Ensure the assembly is sufficiently tight to prevent vacuum bleed-off at diaphragm mounting site.

g. Remove the diaphragm cover and block the upper diaphragm vacuum port at the lower side of the diaphragm seating surface. Apply 60 kPa (18 in.-Hg.) vacuum to the casting through the lower port as in Step d. If the vacuum is now held, go to Step f. If the vacuum is not held, locate and service the excess bleed-off at choke cap gasket, choke shaft bearing, etc. When the problem is fixed and the vacuum is now held, unblock the upper vacuum port. Reassemble the diaphragm and cover which were just removed and repeat Step d. Be sure the assembly is sufficiently tight to prevent vacuum bleed-off at the diaphragm mounting site.

NOTE: This casting check is required only once for the entire test.

C. Choke Cap Resistance Test

1. Connect one lead of an ohmmeter to choke cap terminal and the other lead to choke cap ground. Ensure metal-to-metal contact is achieved (not metal-oxide film-metal) and false readings are prevented. Throughout this test, the ohm reading should be under 30 but never zero. At any point of this test, if the ohm reading is outside this range, start the test all over. If this same improper reading repeats, the choke cap is defective. The cap should be replaced per Shop Manual, Group 24.

2. With the choke cap connected electrically, start the engine and run for 3 minutes. Shut the engine off. During this three minutes, the CER should remain seated for an engine which was warm at the beginning. This rod should gradually lower to seat for an engine which was cold at the beginning. If the CER does not respond this way, note this fact and continue on with the test.

3. The choke cap should be quite warm to the touch now. using choke tester, cool the cap down by directing cold air towards the oval-shaped insulator (not the case) around the cap terminal. The ohm reading should gradually vary and eventually a sudden increase is noticeable. Stop the cooling. This sudden increase should take place within 10 minutes since cooling began, if the Rotunda tool is employed at maximum effectiveness and was placed as close to the cap as possible. If this sudden resistance change does not take place within the above time limit, the choke cap is defective and should be replaced per Shop Manual, Group 24. If this sudden change takes place within this time limit, continue on with the testing.

4. Using the choke tester of Step 3 (or equivalent), warm up the cap by directing hot air towards the oval-shaped insulator. The ohm reading should vary gradually and eventually a sudden decrease is noticeable. Stop the warming. This sudden decrease should take place within 10 minutes since warming began, if the tool is employed at maximum effectiveness and was placed as close to the cap as possible.

   If the sudden resistance change does not take place within the above time limit, the choke cap is defective and should be replaced per Group 24.

   If this sudden change takes place within this time limit, the choke cap has been checked-out all right as far as its resistance is concerned. This means, it generates heat in the way it should.

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5. The choke cap test itself is concluded. However, if the CER response in Step 2 is not proper, the procedure shown in Section II should be performed to identify and service the linkage-related problem that causes this improper response.

IV. Choke Cooling Air Circuit

A. Remove choke cooling air supply line at throttle body and attach a vacuum gauge to the cooling air supply tube.

B. Warm engine to normal operating temperature, and, at curb idle, observe vacuum reading.

C. If vacuum reading is present, remove vacuum gauge, reconnect cooling air supply line, and proceed to Section VI.

D. If no vacuum reading, clean, service, or replace as required; and repeat Section IV Steps A through C, then proceed to Section VI.

V. Carburetor Choke Adjustment—CER, CVR Settings

CER 24°C (75°F) Run, CER —18°C (0°F) Start and Control Vacuum Regulator Setting

A. Cold Enrichment Rod (CER) Adjustment Sequence

NOTE: The CER mechanism affects carburetor air/fuel mixtures throughout engine operation, cold and warm. Several adjustments are required. Although each adjustment does affect a particular phase of operation, and each "maladjustment" can lead to a particular performance symptom, the adjustment procedure must be performed completely and in the following described sequence to provide desired CER performance.

If adjustment cannot be accomplished due to epoxy in the adjustment nut, a new service assembly (9F685) must be installed. Refer to Step B.

1. Remove carburetor from engine.
2. Assemble Dial Indicator Kit TOOL-4201-C or equivalent, to carburetor.

   NOTE: CER adjustment specifications are listed on a tag attached to the carburetor above the choke cap (Figure 1), and published in the Special Specifications Issue ISB Publications.

3. Remove choke diaphragm cover and spring.
4. Remove choke cap according to appropriate instructions.
5. Compress the idle speed positioner where applicable and insert a 5/16–1/2 inch spacer between the positioner stem and the throttle lever contact paddle. Retain in this position with a rubber band. This will locate the fast idle pick-up lever away from the cam and allow the cam to rotate freely.

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6. Install Stator Cap T77L-9848-A or equivalent as a weight to rotate bimetal lever counterclockwise (CCW) and seat the CER.
7. Install dial indicator with tip centered on top surface of CER. Set the dial indicator to "zero". Raise weight slightly and release to check for accurate "zero".

NOTE: This adjustment will be the reference for other adjustments. Be sure dial indicator reading is accurate (Figure 2).

B. Control Vacuum Regulator (CVR) Swivel Assembly Replacement

Refer to Figure 3.

CVR/CER nuts have cylindrical projections above the threads which are filled with epoxy after final adjustment. To adjust, the existing parts must be removed and a new assembly installed. After adjusting, CVR/CER nut cavities must again be filled with epoxy.

1. Remove the E-clip and hinge pin.
2. Turn the CER adjusting nut counterclockwise until nut disengages from rod.
3. Remove the CVR and swivel assembly. Replace with new assembly.
4. The unbroken rod must be in place first before further assembly. Install the assembly and tighten the CER adjusting nut to lower and locate into position. Connect lever to swivel.
5. Install the hinge pin and E-clip.
6. For CVR/CER adjustments, refer to Step 3.
7. Fill two nuts and stop screw with MT13 epoxy or equivalent.

NOTE: The rod has an undercut designed to break, if breakage does occur, a new rod assembly must be installed. The upper body must be loosened to position the rod through the opening. Replace the upper body gasket as necessary (Fig. 4).

C. CER Run Position (24°C, 75°F) Adjustment

Refer to Figure 5.

1. Install stator cap and rotate clockwise (CW) to index. Dial should indicate the tag specification for Run at 24°C (75°F) ± 0.010 inch.
2. Adjust by turning choke adjusting nut CW to increase or CCW to decrease height.

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D. CER Start (Crank) Position (18°C, 0°F) Adjustment

Refer to Figure 6.

1. Remove stator cap.
2. Rotate choke bimetal lever CW until CER travel stop screw bottoms on choke seal retainer (full travel). Dial should indicate the tag specification for Start at 18°C (0°F) ± 0.005 inch.
3. Adjust by turning CER travel stop screw with 5/64 inch hex wrench, CW to decrease or CCW to increase height.

E. Choke Diaphragm Start (Crank) Position for Warm Engine (24°C, 75°F)

Refer to Figure 7.

1. Push in diaphragm assembly. Dial should indicate the tag specification for Start at 24°C (75°F) ± 0.020 inch.
2. Adjust by rotating the diaphram assembly CW to decrease or CCW to increase height.

F. Control Vacuum Rod (CVR) Position

Refer to Figures 8 and 9.

1. Seat CER again using stator cap weight and check for "zero" dial indicator reading. Reset "zero" position of indicator if required. Remove stator cap weight (Figure 8).
2. Depress the CVR until seated. Dial should indicate the tag specification for CVR ± 0.10 inch.
3. Adjust by holding CVR with 3/8 inch wrench, and turning adjustment with 3/32 inch hex wrench CW to decrease or CCW to increase height, (Figure 9).
4. Reinstall original choke diaphragm cover with original spring.

G. Choke Diaphragm Run Position for Cold Engine (—18°C, 0°F)

Refer to Figure 10.

1. Apply vacuum to choke diaphragm cover, or, depress choke diaphragm rod to seated position.
2. Rotate choke bimetal lever CW until choke shaft lever pin contacts fast idle intermediate lever. Dial should indicate the tag specification for Run at 0°F ± 0.005 inch.
3. If an adjustment is required, remove the choke diaphragm cover and install a new cover with the original spring. This is necessary due to tamper-resistant material on the adjustment screw.
4. Adjust by rotating screw in diaphragm housing with 5/64 hex wrench, CW to increase or CCW to decrease height.
5. Apply sealing liquid on adjustment screw to secure adjustment.
6. Install lead ball plug in adjusting screw hole.

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H. Fast Idle Cam Setting

Refer to Figure 11.

Position fast idle pick-up lever on second step of fast idle cam against shoulder of high step.

1. Install stator cap and rotate CW until fast idle pick-up lever contacts fast idle cam adjusting screw. Dial should indicate specification 0.360 inch ± 0.005 inch.
2. Adjust by rotating fast idle cam adjusting screw.
3. Remove stator cap.
4. Assemble choke cap, gasket, and retainer with break-away screws.
5. Remove dial indicator and rubber band.
6. Install carburetor and adjust idle speeds.

VI. Post-Check Instructions

A. Inspect the gaskets and sealing surfaces between the carburetor and intake manifold. Service as required.

B. Reinstall the carburetor.

C. Reconnect all wire connections and hoses.

D. Check/adjust engine idle speeds.

E. Reinstall the air cleaner assembly and reconnect pertinent vacuum lines.* Tighten air cleaner wing nuts to specification.

Verify that air cleaner heat riser tube and fresh air pick-up connections are correct.

VII. Removal and Installation of Adjustment Limiting Choke Bimetal Housing and Enrichment Rods

A. Refer to Shop Manual, Group 24.

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*Refer to the Special Specifications Issue TSB Publications.

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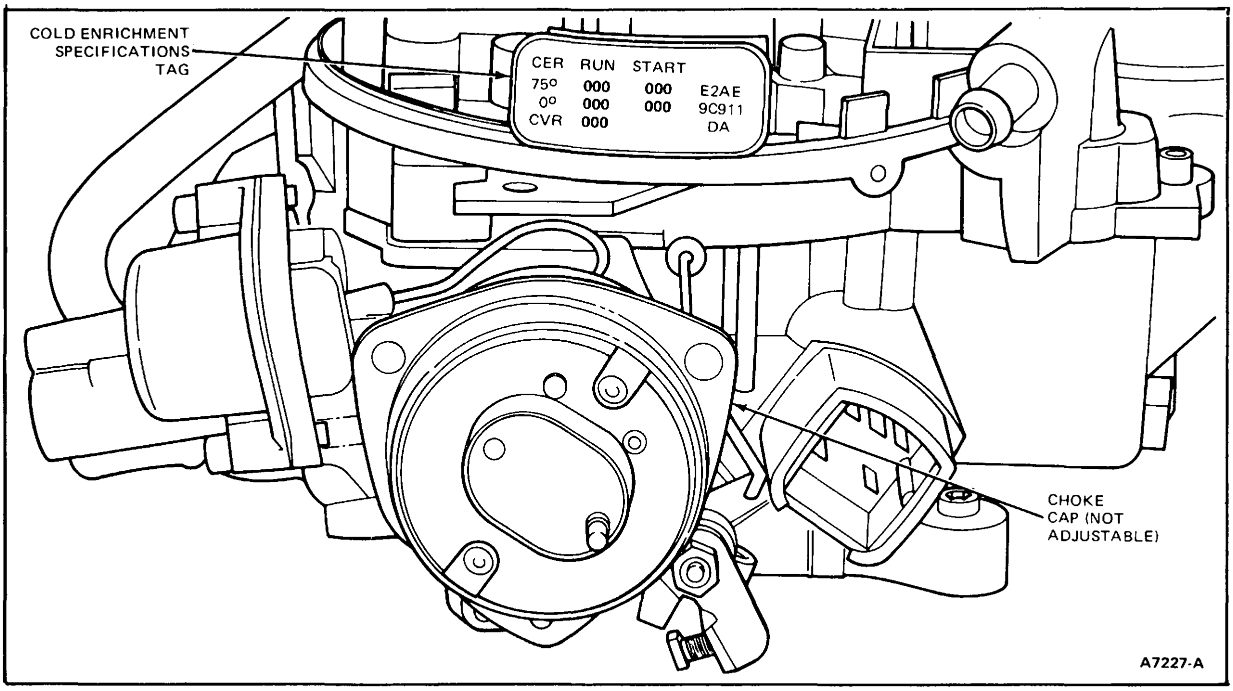

Figure 1 Cold Enrichment Rod (CER) Adjustment Sequence

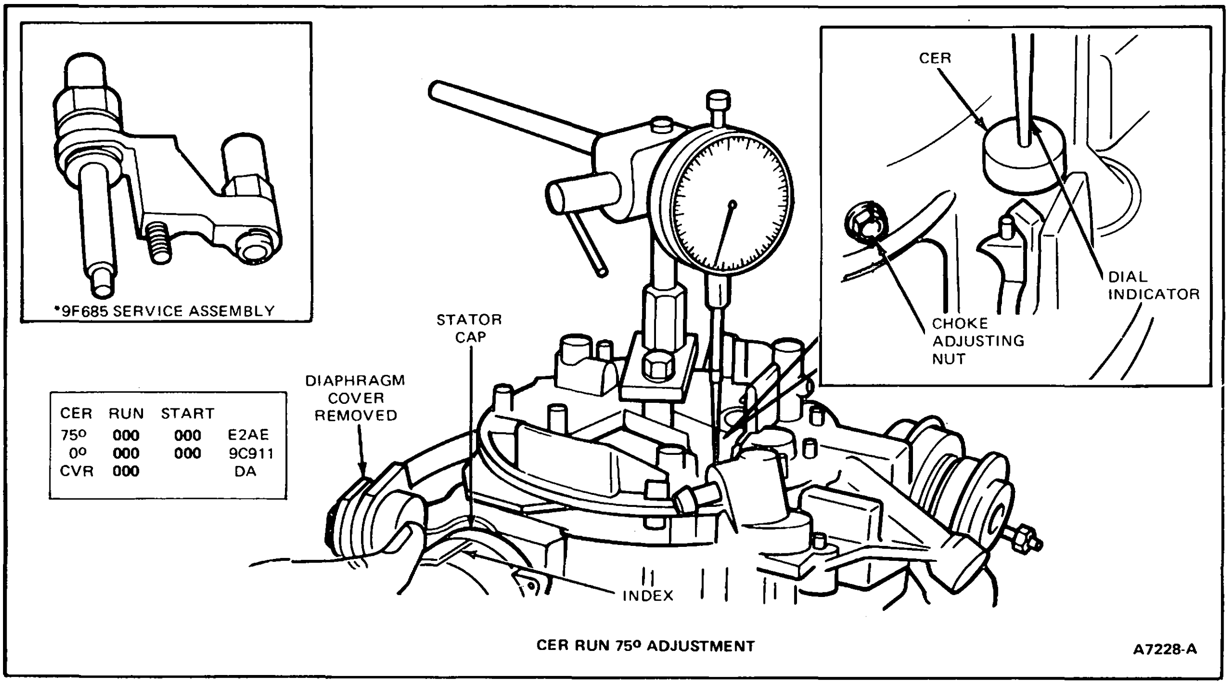

Figure 2 CER Run Position (24°C, 75°F) Adjustment

Cold Enrichment System

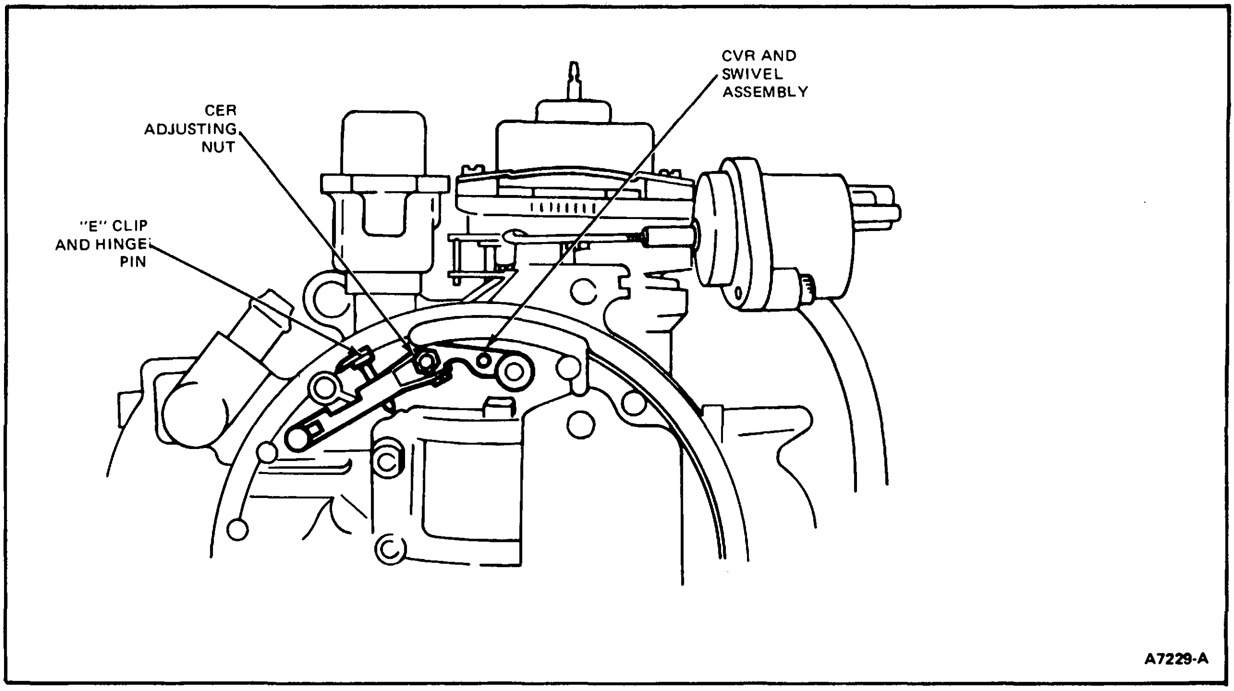

Figure 3 Control Vacuum Regulator (CVR) Swivel Assembly Replacement

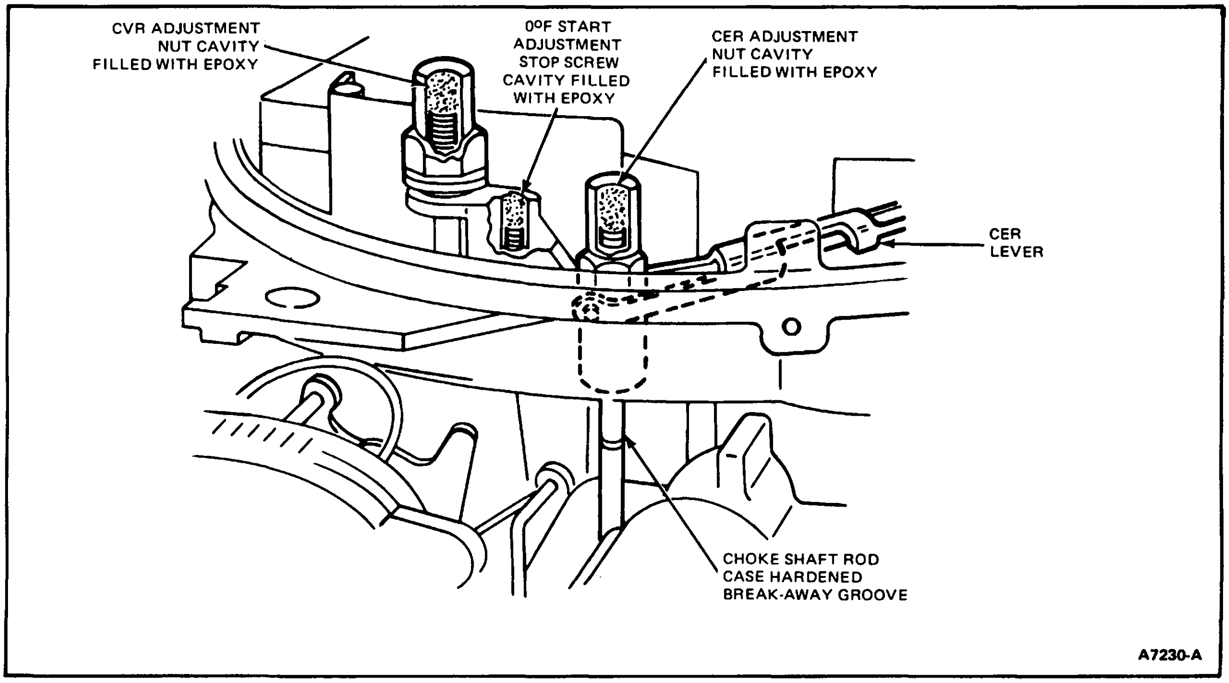

Figure 4 CER/CVR Tamper Resistant Installation

Cold Enrichment System

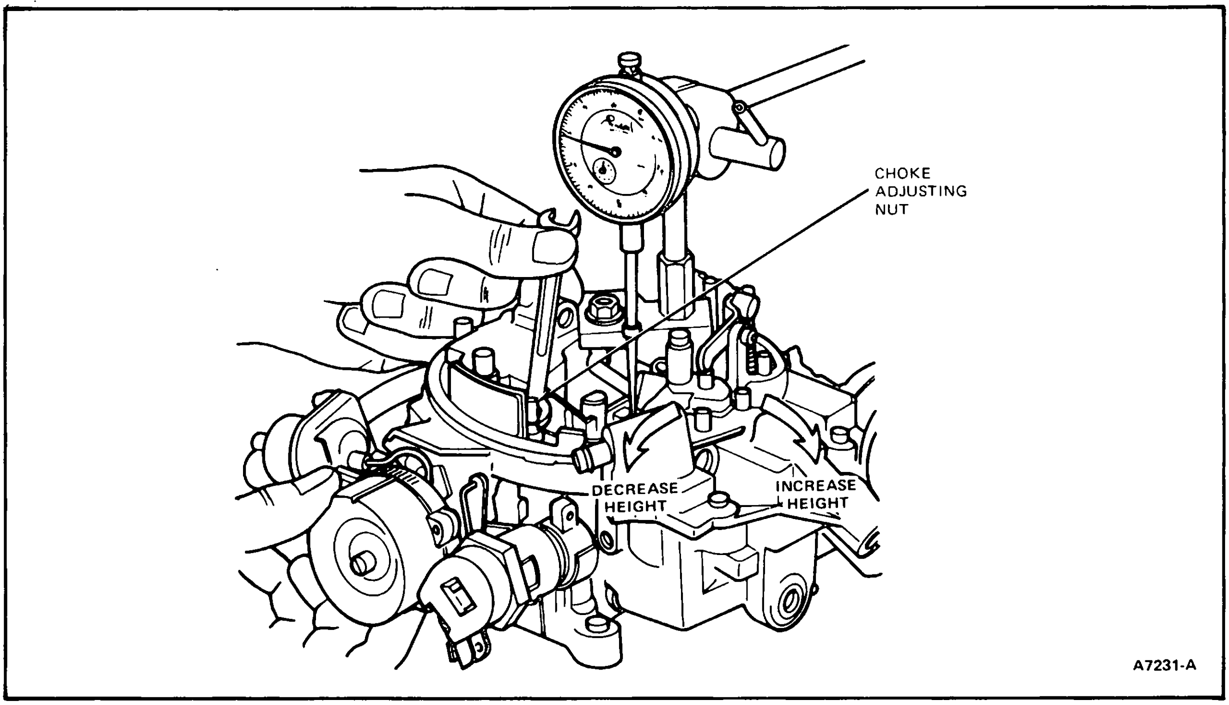

Figure 5 CER Run Position (24°C, 75°F) Adjustment

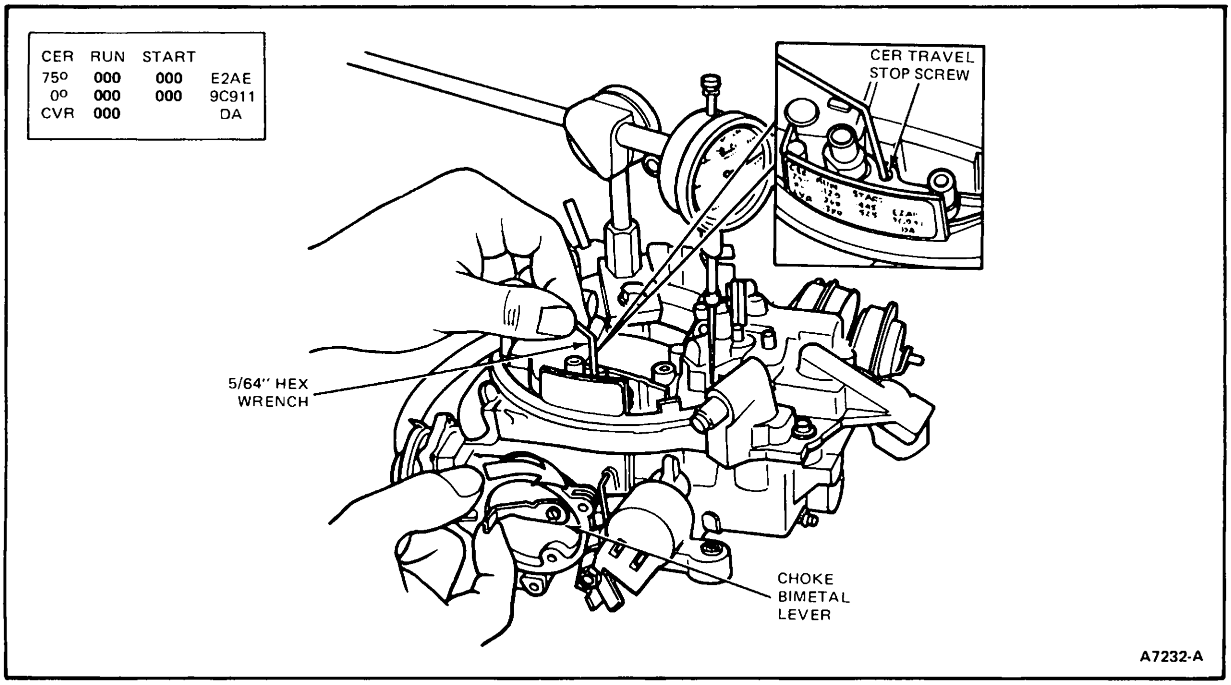

Figure 6 CER Start (Crank) Position (—18°C, 0°F) Adjustment

Cold Enrichment System

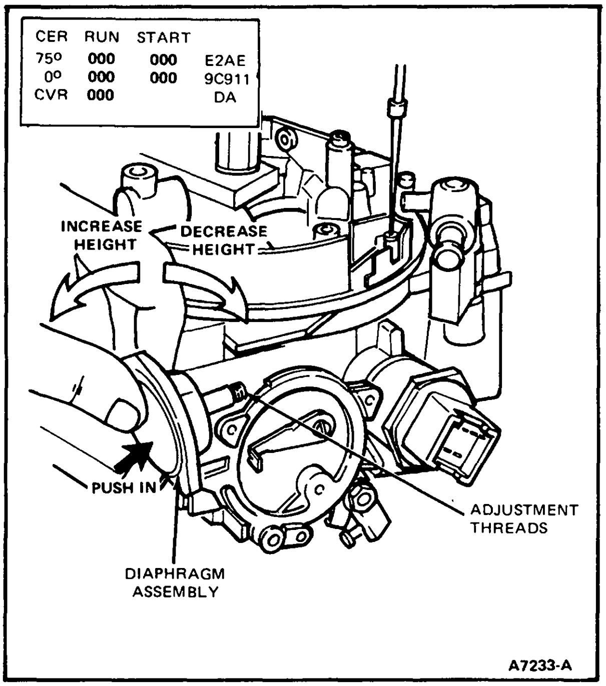

Figure 7 Choke Diaphragm Start (Crank) Position — Warm (24°C, 75°F)

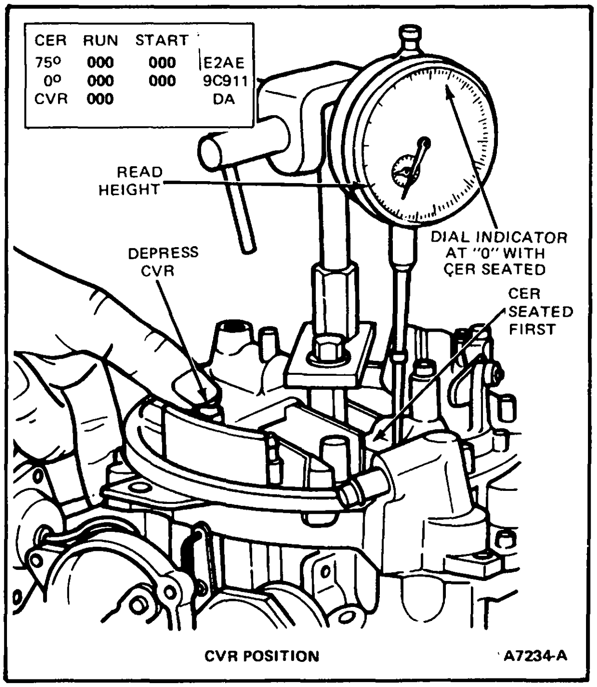

Figure 8 Control Vacuum Rod (CVR) Position — Check

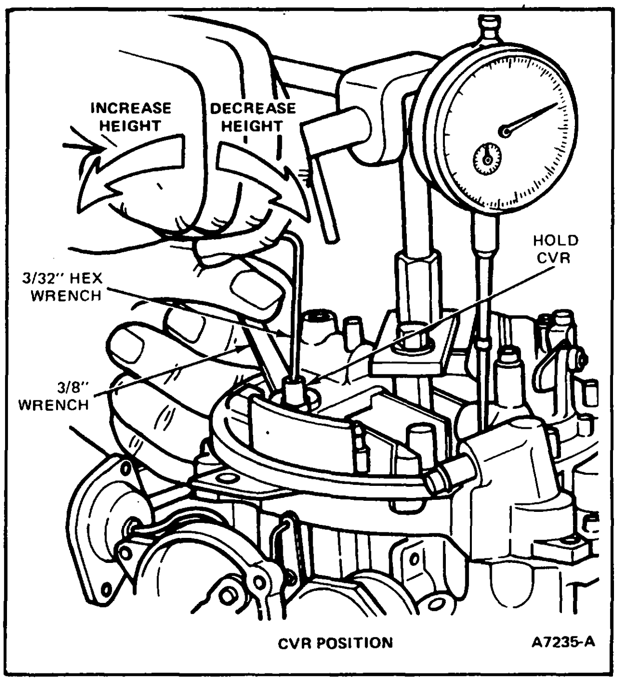

Figure 9 Control Vacuum Rod (CVR) Adjustment

Cold Enrichment System

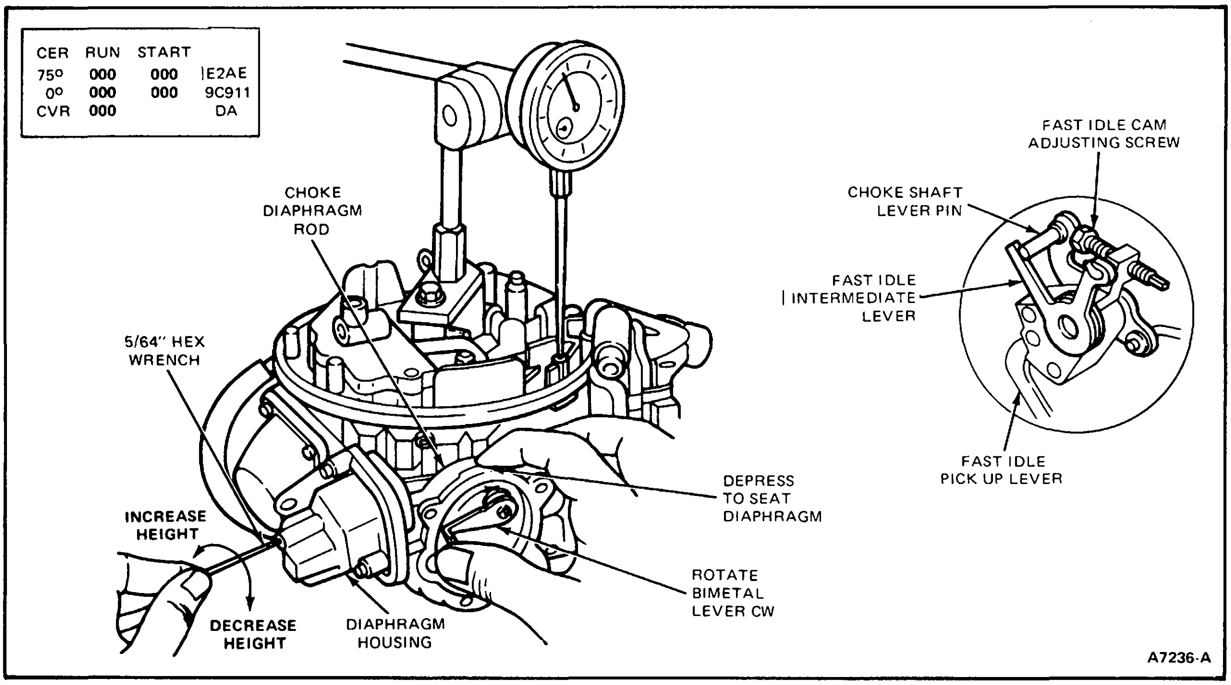

Figure 10 Choke Diaphragm Run Position for Cold Engine (—18°C, 0°F)

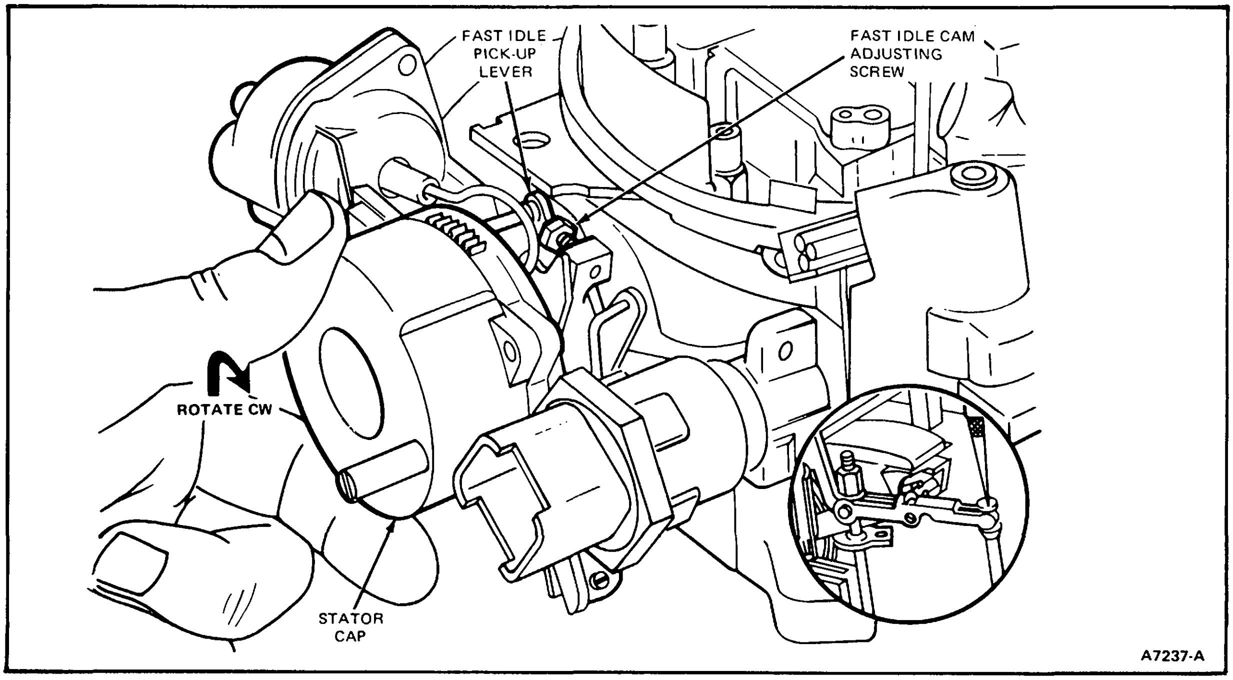

Figure 11 Fast Idle Cam Setting

Choke Adjustment Procedure

5.8L & 7.5L TRUCK
AUTOMATIC CHOKE SYSTEM—HOLLEY 4180C-4V (ELECTRIC)

I. Pre-Check Instructions

A. Apply parking brake, and block the wheels.

B. Start the engine, bring to normal operating temperature, and turn Off.

C. Remove the air cleaner assembly, and plug the vacuum hose(s) to the air cleaner.

II. Freedom of Linkage and System Integrity Check

A. Verify that all vacuum hoses and solenoid wires are properly connected and intact; correct as required. Check torque of carburetor holddown nuts; retighten to specification, if necessary.*

B. Check all carburetor linkages for freedom of operation as follows:

1. Bring engine to normal operating temperature and manually depress the throttle lever to ¼ open position, and rotate the choke plate to the closed position. Release the choke plate; the choke plate should rotate smoothly to the open position. If sticking or binding is exhibited, clean/service/replace/adjust the choke linkage, as required, to restore freedom of choke plate movement.

III. Electric Choke Functional Test

The Holley 4V carburetors for the 5.8L & 7.5L (over 8500 GVW) engines use an alternator powered (7.2V) dual pill electric choke system. The choke power lead is connected to the alternator stator terminal. The Holley 4V carburetor for the 5.8L (under 8500 GVW) engine uses a battery powered 12V source from a relay located on the RH fender apron.

A. Choke Cap Continuity:

a. Turn ignition switch Off.

b. Connect one lead of a test lamp to the positive terminal of the battery and the other lead to the choke cap terminal. If the lamp glows, proceed to Step B.

c. Connect one end of a jumper wire to the choke shroud and the other end to the positive terminal of the battery.

d. The test lamp should indicate continuity, if not, connect the jumper wire directly to the choke cap ground, if the lamp lights up, correct the poor continuity between the choke clamp shroud and the choke cap ground. If the lamp does not light up, replace the choke cap per procedure in Shop Manual, Group 24.

B. Continuity of all circuit components, alternator powered choke:

1. Connect one lead of a test lamp to the choke cap wire and the other lead to the negative terminal of the battery.
2. Start the engine, the test lamp should indicate continuity. If not, locate and service the open circuit between choke cap to alternator stator terminal. If no open circuit is found, check alternator output and service as required.

---

*Refer to the Special Specifications Issue TSB Publications.

Choke Adjustment Procedure

C. Continuity of all circuit components, battery powered choke:

1. Connect one lead of a 12V test lamp to choke cap wire and the other lead to the negative terminal of the battery or other ground source.
2. Start the engine, the test lamp should indicate continuity. If not, locate and service open circuit in wire to choke relay from relay back to alternator stator feed, or other -9E724- wire harness connections. If no open circuit is found check choke relay for proper function, replace if required.

D. Choke Cap Resistance Test.

1. With an ohmmeter, set to lower range that will indicate 30-ohms (maximum). Connect one lead of an ohmmeter to choke cap terminal and the other lead to choke cap shroud. Ensure metal-to-metal contact is achieved (not metal-oxide film) and false readings are prevented. The ohm reading should be under 30 but never zero. If the ohm reading is outside this range, start the test all over. If this improper reading repeats, the choke cap is defective. The cap should be replaced per Shop Manual, Group 24.

IV. A. Choke Pulldown

1. Remove carburetor from vehicle and cover intake manifold.
2. Place carburetor on a stand which allows access to the pulldown diaphragm vacuum passage on the underside of the throttle body, Figure 1.
3. Mark choke cap and choke housing as indicated on Figure 2. Remove choke cap, gasket, and retainer. Refer to Shop Manual, Group 24 for removal (of the choke cap retainer) instructions.
4. Reinstall choke cap temporarily with a standard choke cap gasket. Line up marks made previously on the cap and housing and rotate cap 90 degrees counterclockwise from that position. Secure with one screw.
5. With the choke plate in the full closed position, actuate the choke pulldown motor using an outside vacuum source, (17 in.-Hg. minimum) in the diaphragm vacuum passage.
6. Using a drill gauge of the specified size check the clearance between the lower edge of the choke plate and the air horn wall. **NOTE: The gauge should fit in such a manner that it contacts the air horn and choke plate but does not move the plate.**
7. If the pulldown dimension is out of specification, carefully remove the diaphragm adjustment screw cap with a small sharp punch or screwdriver, Figure 3.
8. Turn the adjustment screw with a 5/64 inch Allen wrench clockwise to decrease the pulldown set or counterclockwise to increase the pulldown set. **NOTE: Maintain a minimum of 17 in.-Hg. to the pulldown diaphragm during adjustment. Cycle vacuum from 0 to 17 in.-Hg. to verify proper set.**
9. Apply RTV sealant to the adjustment screw cavity and check the fast idle cam adjustment.

Choke Adjustment Procedure

B. Fast Idle Cam Index Adjustment

1. With the choke cap still wrapped, and with vacuum applied to the diaphragm, cycle the throttle. The fast idle screw should rest on the Hi step of the fast idle cam, Figure 4. If no adjustment is required proceed to Step 3.
2. If the fast idle cam requires adjustment, refer to Figure 5. Turn the Allen adjustment screw clockwise to position the fast idle screw higher on the No. 2 step or counterclockwise to position the fast idle screw lower on the No. 2 step.
3. Remove the temporary choke cap gasket, install the original locking gasket, choke cap and choke cap retainer. Secure with breakaway screws.

C. De-choke

Refer to Figure 4.

1. Hold the throttle in the wide open position.
2. Apply light closing pressure on the choke plate and measure the gap* between the lower edge of the choke plate and the air horn wall.
3. To adjust, bend the pawl on the fast idle lever.

V. Post-Check Instructions

Reinstall air cleaner assembly and reconnect pertinent vacuum lines. Tighten air cleaner wing nut to specification.

*Refer to the Special Specifications Issue TSB Publications.

Choke Adjustment Procedure

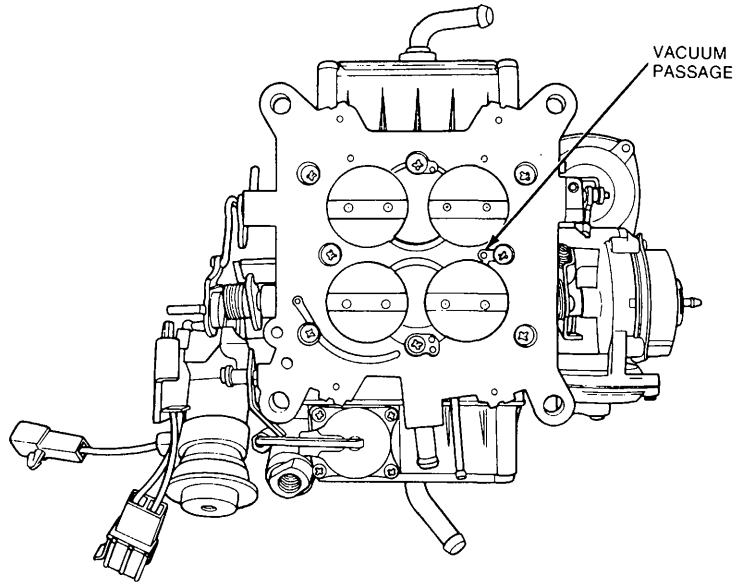

Figure 1 Holley 4180-C 4V — Pulldown Diaphragm Vacuum Passage

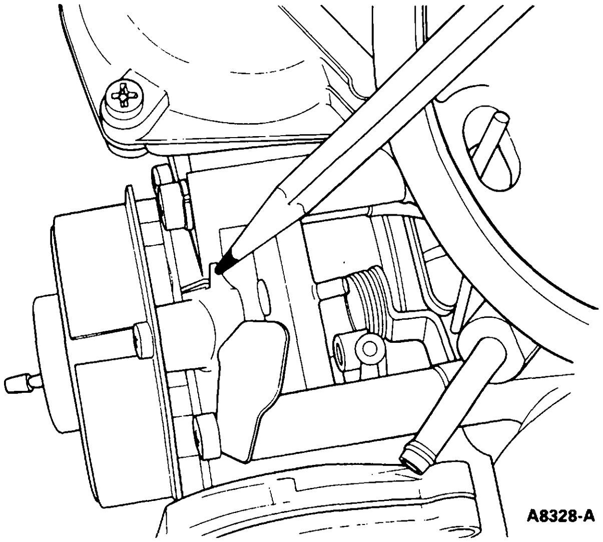

Figure 2 Holley 4180-C 4V — Choke Cap Index Location Identification

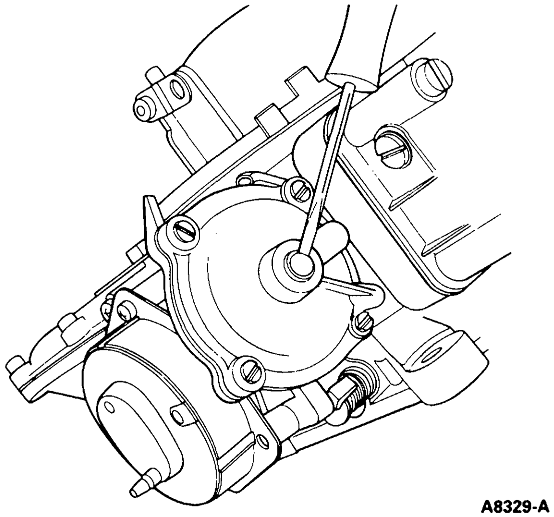

Figure 3 Holley 4180-C 4V — Pulldown Diaphragm Adjustment Screw Cap Removal

Choke Adjustment Procedure

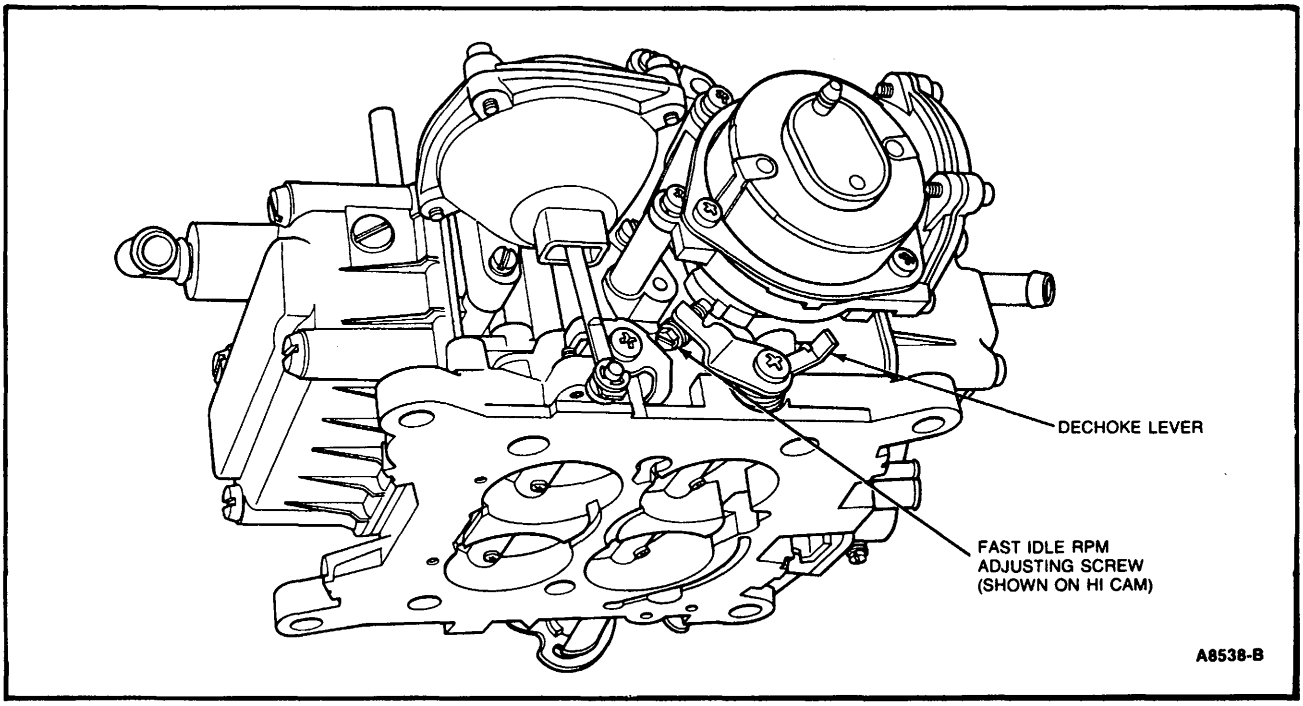

Figure 4 Holley 4180-C 4V — Fast Idle Cam Index Set — Second Step

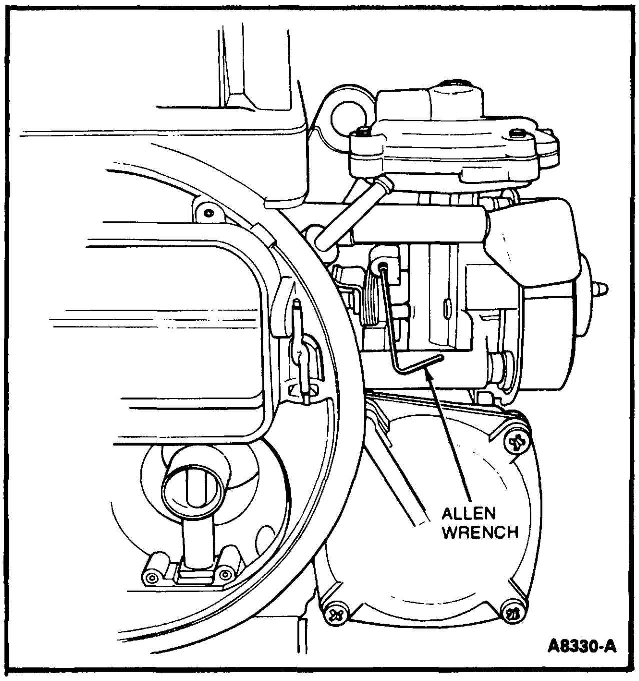

Figure 5 Holley 4180-C 4V — Fast Idle Cam Index Adjustment

Choke Adjustment Procedure

TRUCK

MANUAL CHOKE CARBURETORS ONLY—HOLLEY 4190 EG-4V

I. Pre-Check Instructions

A. Apply parking brake, and block wheels. Manual/Auto transmission in Neutral or Park.

B. Bring the engine to normal operating temperature.

C. Remove the air cleaner assembly and plug the vacuum line(s) to the air cleaner assembly.

D. Disconnect choke cable from carburetor.

E. Check all carburetor linkages for freedom of operation. Service or replace and adjust as required.

F. Check for freedom of operation of choke plate for closing and opening in the air horn bore. Correct as required.

G. Reconnect choke cable and check choke plate travel using dashboard control. Depress throttle and pull choke full on. Choke should be fully closed in air horn bore. Depress throttle and push choke in. Choke should be fully open. Correct choke cable adjustment as required.

II. Post-Check Instructions

Reinstall the air cleaner assembly and reconnect pertinent vacuum lines. Tighten the air cleaner wing nut to specification.

*Refer to Shop Manual, Group 24.

Decel Throttle Control System

DECEL THROTTLE CONTROL SYSTEM — CHECK

All of the following checks are to be made with the engine at full operating temperature and all accessories OFF.

CONDITION	POSSIBLE SOURCE	ACTION
System Quick Check ● With engine at idle, accelerate to 2000 RPM or more than fall back to idle. (**NOTE:** On deceleration, manifold vacuum must exceed 69.6 kPa (20.6 inches Hg.) when the system includes a vacuum solenoid valve).	● Vacuum diaphragm plunger extends and retracts. ● Vacuum diaphragm plunger does not extend and retract.	● System is functioning. ● The sytem is not functioning, continue below.
Throttle Positioner Check ● Apply 64 kPa (19 inches Hg.) vacuum to diaphragm and trap.	● Diaphragm responds and holds vacuum. ● Diaphragm does not respond or will not hold vacuum.	● Go to next Step. ● Replace diaphragm.
● Remove vacuum	● Diaphragm returns within 5 seconds. ● Diaphragm does not return in 5 seconds.	● Diaphragm is good. ● Replace diaphragm.

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VACUUM SOLENOID VALVE CHECK

NOTE: The 9D474 is also known as EGR solenoid valve. The following checks are made at normal running temperature with all accessories OFF and engine idling. 1. Check vacuum supply to the valve.	● Good vacuum. ▶ ● No vacuum. ▶	● Go to 2. ● Service as required.
2. With battery voltage on one terminal, ground the other.	● Speed increase. ▶ ● No speed increase. ▶	● Go to 3. ● Replace solenoid.
3. Remove ground.	● Return to idle. ▶ ● Does not return to idle. ▶	● Solenoid is okay. ● Replace solenoid.

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Decel Throttle Control System

ELECTRONIC SPEED SENSOR MODULE (USED WITH 460 CID ONLY)

1. Harness Check. With ignition ON, check voltage between ground and:		
a. Terminal 1 (nearest locator key)	• 12 volts Less than 12 volts.	▶ • Go to b. Service harness.
b. Terminal 4	• 12 volts Less than 12 volts.	▶ • Go to c. Service harness.
c. Terminal 6	• 6-8 volts not 6-8 volts.	▶ • Harness OK Service harness.

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ELECTRONIC GOVERNOR MODULE CHECK

1. Check harness to following chart.
   NOTE: No. 1 terminal is nearest to locator key.

Terminals	Condition	Meter Type	Value
1-2	• Engine running.	• Tachometer	• Engine RPM
1-8	• Key On	• Volt	• 12 volts
4-6	• Key Off	• OHM	• Continuity
5-7	• Key Off	• OHM	• Continuity

Service wiring as required.

2. Repeat "System Quick Check." If system is not functioning and all other components have been checked as OK, replace the governor module. CA6054-B

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SECTION 5

Catalyst and Exhaust Systems

Contents

Catalytic Converter System 5-1

Exhaust Heat Control Valve 5-2

Restricted Exhaust System Diagnosis — Lack of Power or Induction Backfire 5-3

Catalyst and Exhaust Systems

DESCRIPTION

Catalytic Converter System

The engine exhaust consists mainly of Nitrogen (N_2), however, it also contains Carbon Monoxide (CO), Carbon Dioxide (CO_2), Water Vapor (H_2O), Oxygen (O_2), Nitrogen Oxides (NOx), and Hydrogen (H_2) as well as various, unburned Hydrocarbons (HC). Three of these exhaust components — CO, NOx, and HC — are major air pollutants, so their emission to the atmosphere has to be controlled.

The catalytic converter, mounted in the engine exhaust stream, plays a major role in the emission control system. The converter works as a gas reactor, and its catalytic function is to speed up the heat producing chemical reaction between the exhaust gas components in order to reduce the air pollutants in the engine exhaust. The catalyst material, contained inside the converter, is made of a ceramic substrate that is coated with a high surface area alumina and impregnated with catalytically active, precious metals (Fig. 1).

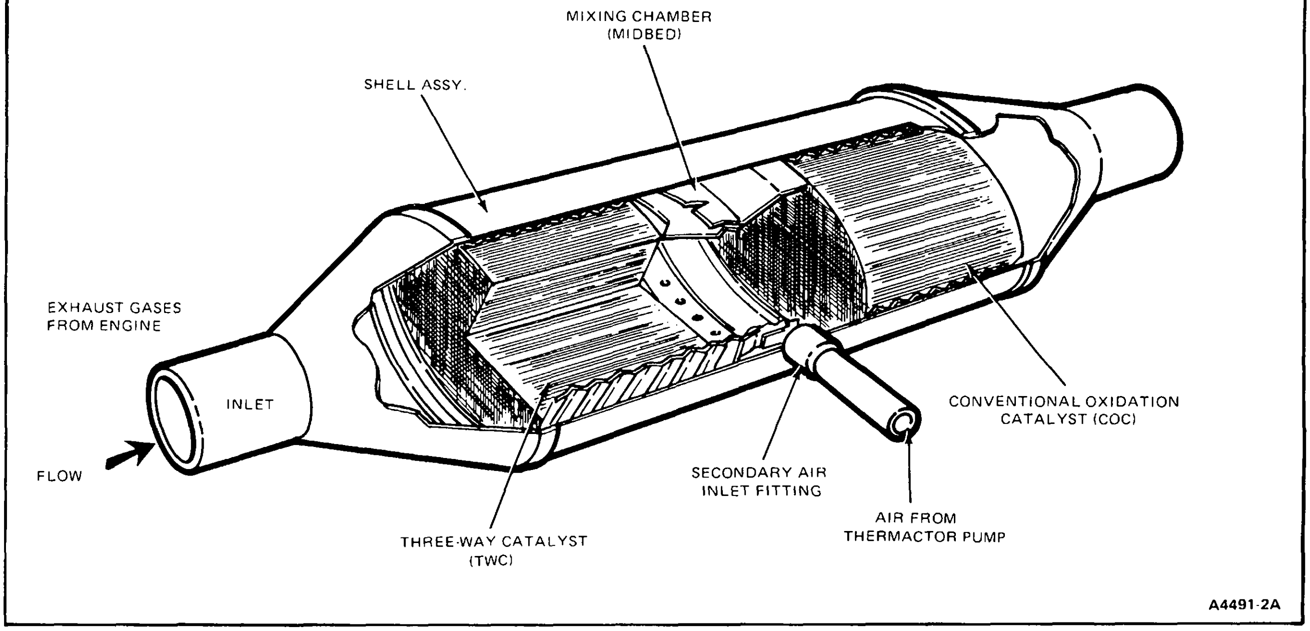

Figure 1 Dual Catalytic Converter

It is the surface of the catalyst material that plays a major role in the heat producing chemical reaction. There are basically three types of catalysts:

1. The conventional oxidation catalyst (COC), containing Platinum (Pt) and Palladium (Pd), is effective for catalyzing the oxidation reactions of HC and CO.
2. The three-way catalyst (TWC), containing Platinum (Pt) and Rhodium (RH) or Palladium (Pd) and Rhodium (RH), is not only effective for catalyzing the oxidation reactions of HC and CO, but it also catalyzes the reduction of NOx.

Catalyst and Exhaust Systems

3. The Light Off Catalyst (LOC) is a single bed converter. It is arranged in series with the main catalytic converter assembly of COC and/or TWC as the aft member(s). This converter is designed to perform the very specialized function of exhaust emission control during engine warm-up when the main converter(s) is not yet at the temperature required for maximum efficiency. The LOC is designed to operate effectively in the high temperature environmental conditions that exist near the manifold flange. The LOC was designed with a minimum heat sink effect and, therefore, provides minimum delay in warm-up of the main catalytic converter(s).

The catalytic converter assembly consists of a structured shell containing a monolithic substrate — a ceramic, honeycomb construction. In order to maintain the converter's feed gas (exhaust) oxygen content at a high level to obtain the maximum oxidation for producing the heated chemical reaction, the oxidation catalyst requires the use of a secondary air source, and this is provided by the pulse air or thermactor air injection systems.

The catalytic converter system is protected by several devices that block out the secondary air supply from the thermactor air injection system when the engine is laboring under any abnormal hot or cold operating situation.

Depending on the engine calibration, these block-out devices are functional under one or more of the following conditions:

- Cold engine operation with rich choke mixture.
- Abnormally high engine coolant temperatures above 107°C (225°F), which may result from a condition such as an extended, hot idle on a hot day.
- Wide open throttle.
- Engine deceleration.
- Extended idle operation.

A complete description of the design and operation of these block-out devices can be found in Thermactor Systems, Section 10.

Exhaust Heat Control Valve

Exhaust Heat Control Valve Bimetal Type

The valve is normally in the closed position — engine cold and not running to divert exhaust gases to the intake manifold riser pad. When the engine is started, the heat from the exhaust gases actuates the bimetal spring which opens the valve. As operating temperatures are reached, the valve will remain open. The valve, when cold, will also open at high engine speeds, due to the action of the exhaust gas on the unbalanced valve plate.

A. Inspect valve assembly for any abnormal condition. Service or replace as necessary.

B. Lubricate the valve with C0AZ-19A501-A or C4AZ-19A501-A graphite lube or equivalent.

C. Check valve and thermostatic spring operation by manually rotating the valve shaft. Valve must be free and return to the closed position when cold (Rotunda Choke Tester Model 090-00001 or equivalent may be used if necessary to cool bimetal).

Vacuum Operated Heat Control Valve

Refer to Components, Section 3 for description and operation.

Catalyst and Exhaust Systems

Restricted Exhaust System Diagnosis — Lack of Power or Induction Backfire

A restricted or blocked exhaust system usually results in loss or lack of power or popping through the carburetor. Verify that the condition is not caused by ignition or timing problems, then proceed with diagnosis per the following procedure.

TEST STEP		RESULT ▶	ACTION TO TAKE
B0	VISUAL INSPECTION		
	• Visually inspect the exhaust system. • Is the exhaust system visually OK?	Yes ▶	GO to **B1**.
		No ▶	REPLACE any collapsed exhaust components. If problem is not corrected, GO to **B1**.
B1	VACUUM TEST		
	• Attach vacuum gauge to intake manifold vacuum source. • Hook up tachometer. • Start engine and gradually increase speed to 2000 RPM with transmission in Neutral.	Yes ▶	No restriction in exhaust system. REFER to Section 2, Diagnostic Routine 209, Lack of Power.
	• Is the manifold vacuum above 16 inches of mercury?	No ▶	GO to **B2**.
B2	VACUUM TEST — EXHAUST DISCONNECTED		
	• Turn engine OFF. • Disconnect exhaust system at exhaust manifold(s).	Yes ▶	GO to **B3**.
	• Repeat vacuum test. Is the manifold vacuum above 16 inches of mercury?	No ▶	GO to **B4**.
B3	VACUUM TEST — CATALYTIC CONVERTER(S) ON/ MUFFLER(S) OFF		
	• Turn engine OFF. • Reconnect exhaust system at exhaust manifold(s).	Yes ▶	REPLACE muffler(s).
	• Disconnect muffler(s). • Repeat vacuum test. Is the manifold vacuum above 16 inches of mercury?	No ▶	REPLACE catalytic converter and inspect muffler to be sure converter debris has not entered muffler.
B4	EXHAUST MANIFOLD RESTRICTED		
	• Remove the exhaust manifold(s). Inspect the ports for casting flash by dropping a length of chain into each port. **Do not use a wire or light to check ports. The restriction may be large enough for them to pass through but small enough to cause excessive back pressure at high engine RPM.**	Yes ▶	REMOVE casting flash. If flash cannot be removed, REPLACE exhaust manifold(s).
	• Is a restriction present?	No ▶	REFER to Section 2, Diagnostic Routine 209, Lack of Power.

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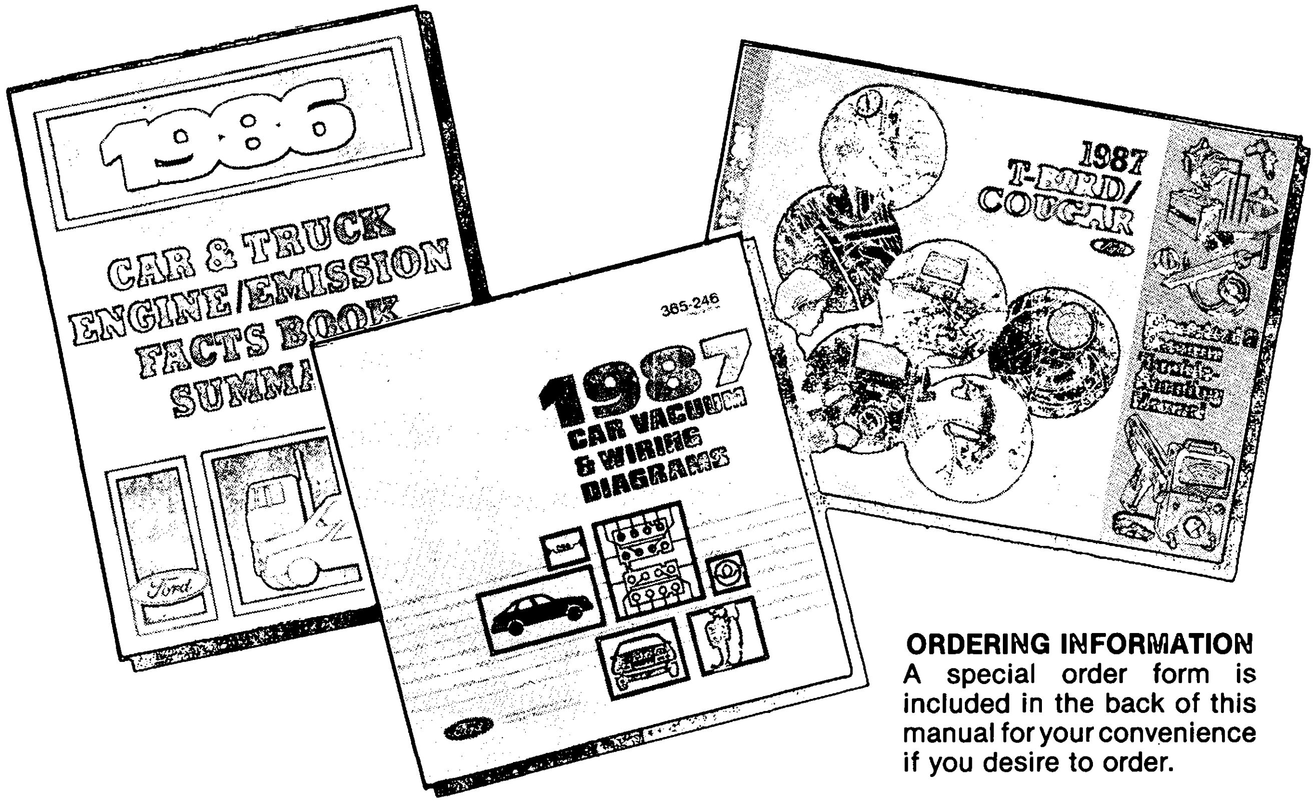

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SECTION 6

Exhaust Gas Recirculation (EGR) Systems

Contents

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Electronic EGR (EEGR) Valve 6-12

Valve and Transducer Assembly 6-13

System Descriptions

Typical Vacuum Operated EGR System

The Exhaust Gas Recirculation System (EGR) is designed to reintroduce exhaust gas into the combustion cycle lowering combustion temperatures and reducing the formation of Nitrous Oxide.

There are four basic types of EGR valves:

- The Integral Backpressure Transducer EGR Valve (9D448)
- The Ported EGR Valve (9D475)
- The Electronic EGR Valve (9F483)
- The Valve and Transducer Assembly EGR Valve (9H495)

Refer to Section 3 for valve description and function.

Typical components connected within the system are:

- EGR Valve.
- PVS and or TVS.
- Carburetor EGR port.

The amount of exhaust gas reintroduced and the timing of the cycle varies by calibration and is controlled by various factors such as engine speed, engine vacuum, exhaust system backpressure, coolant temperature and throttle angle depending on the calibration. All EGR valves are vacuum actuated. The vacuum diagram is shown on the emission decal for each calibration.

Figure 1 shows a typical EGR valve installation.

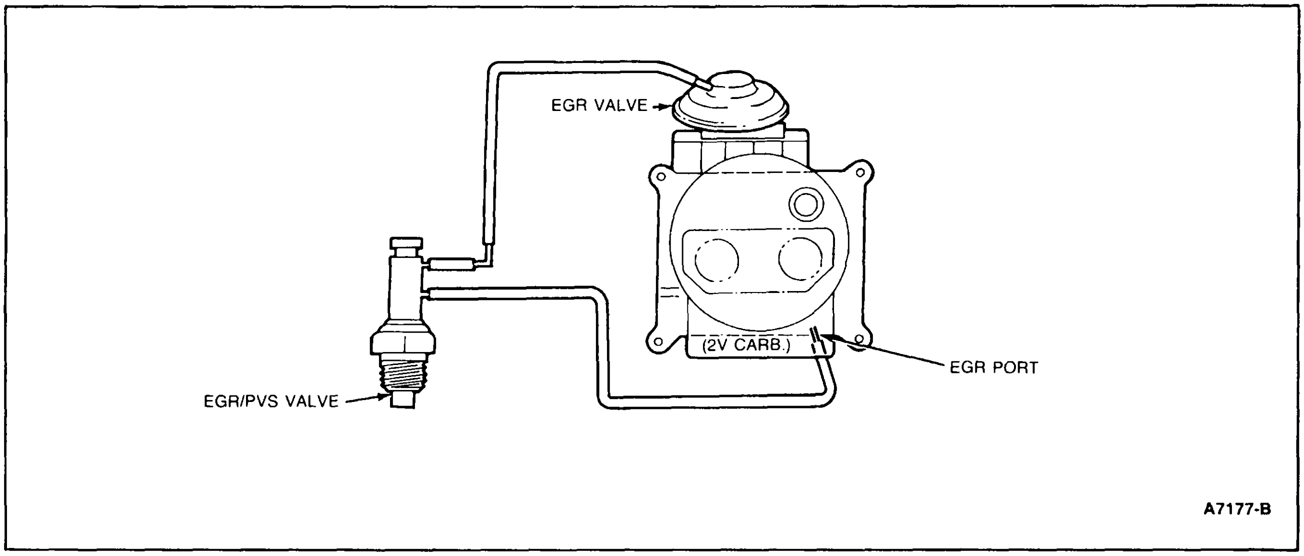

Figure 1 Typical EGR Vacuum System

System Descriptions

Typical Backpressure Variable Transducer (BVT) System

The BVT system is used on most 1.9L and 2.3L passenger car applications. A typical BVT control system is shown in Figure 2. It consists of three components; a vacuum regulator (9J431), EGR valve (9D475) and a flow control orifice.

The regulator modulates the vacuum signal to the EGR valve using two backpressure inputs. One input is the standard vehicle backpressure and the other is the backpressure downstream of the flow control orifice. The control chamber pickup is in the EGR tube and the flow control orifice is integral with the upstream EGR tube connector.

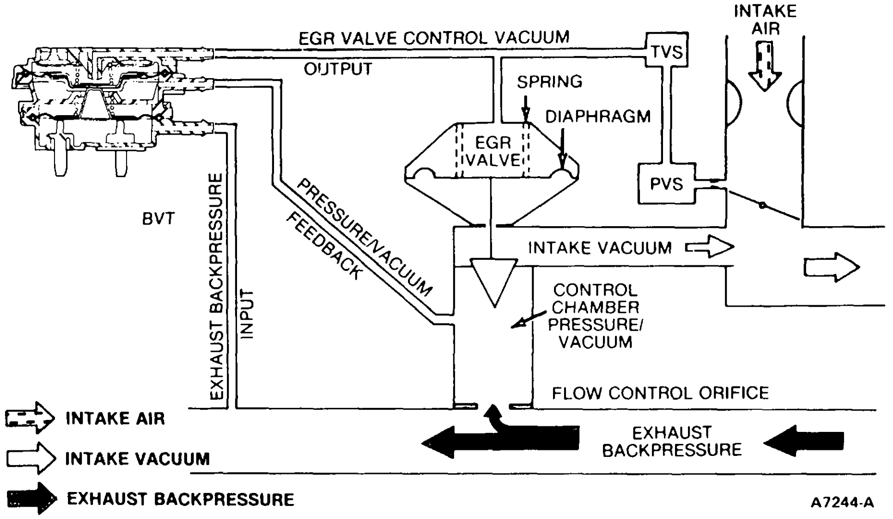

Figure 2 Backpressure Variable Transducer (BVT) Schematic Diagram

Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
• Rough idle-cold	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR, VCV or TVS malfunction.	• Perform EGR, VCV or TVS diagnosis, refer to section 3.
	• Load control (WOT) valve malfunction.	• Perform load control (WOT) valve diagnosis.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Curb idle speed too high or low.	• Reset according to Section 4.
• Rough idle hot	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• Load control (WOT) valve malfunction.	• Perform load control (WOT) valve diagnosis, refer to Section 3.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Curb idle speed too high or low.	• Reset according to Section 4.

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Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
Rough running, surge, hesitation, poor part throttle performance — cold	EGR valve malfunction.	Perform EGR valve diagnosis.
	BVT malfunction.	Perform BVT diagnosis.
	EGR flange gasket leaking.	Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	EGR valve attaching nuts or bolts loose or missing.	Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	EGR, VCV or TVS malfunction.	Perform EGR, VCV or TVS diagnosis, refer to Section 3.
	Load control (WOT) valve malfunction.	Perform load control (WOT) valve diagnosis, refer to Section 3.
	Vacuum leak at EVP sensor.	Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	Ignition timing too low.	Reset to specification shown on emission decal.
Rough running, surge, hesitation, poor part throttle performance — hot	EGR valve malfunction.	Perform EGR valve diagnosis.
	BVT malfunction.	Perform BVT diagnosis.
	EGR flange gasket leaking.	Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	EGR valve attaching nuts or bolts loose or missing.	Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	EGR, VCV or TVS malfunction.	Perform EGR, VCV or TVS diagnosis, refer to Section 3.
	Blocked or restricted EGR passages in valve or spacer.	Clean passages in EGR spacer and if necessary, replace EGR valve.
	Load control (WOT) valve malfunction.	Perform load control (WOT) valve diagnosis, refer to Section 3.
	Vacuum leak at EVP sensor.	Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	Insufficient exhaust backpressure to activate valve.	Check exhaust system for leaks.
	Ignition timing too low.	Reset to specification shown on emission decal.

CA9171-B

Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
• Engine stalls on deceleration — hot and cold	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT functional test.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR, VCV or TVS malfunction.	• Perform EGR, VCV or TVS diagnosis, refer to Section 3.
	• Blocked or restricted EGR passage in valve or spacer.	• Clean passages in EGR spacer and if necessary, replace EGR valve.
	• Load control (WOT) valve malfunction.	• Perform load control (WOT) valve diagnosis, refer to Section 3.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Curb idle speed too high or low.	• Reset according to Section 4.
	• Ignition timing too low.	• Reset to specification shown on emission decal.

CA9172-B

Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
o Engine spark knock or ping	o EGR malfunction.	o Perform EGR valve diagnosis.
	o BVT malfunction.	o Perform BVT diagnosis.
	o EGR flange gasket leaking.	o Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	o EGR valve attaching nuts or bolts loose or missing.	o Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	o EGR, VCV or TVS malfunction.	o Perform EGR, VCV or TVS diagnosis, refer to Section 3.
	o Blocked or restricted passages in valve or spacer.	o Clean passages in EGR spacer and if necessary, replace EGR valve.
	o Vacuum leak at EVP sensor.	o Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	o Insufficient exhaust backpressure to actuate valve.	o Check exhaust system for leaks.
	o Ignition timing too high.	o Reset to specification shown on emission decal.
	o Air cleaner temperature vacuum switch (TVS) malfunction.	o Perform air cleaner temperature switch (TVS) diagnosis, refer to Section 3.
o Engine stalls at idle — cold	o EGR valve malfunction.	o Perform EGR valve diagnosis.
	o BVT malfunction.	o Perform BVT diagnosis.
	o EGR flange gasket leaking.	o Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	o EGR valve attaching nuts or bolts loose or missing.	o Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	o EGR, PVS or TVS malfunction.	o Perform EGR, PVS or TVS diagnosis, refer to Section 3.
	o Load control (WOT) valve malfunction.	o Perform load control (WOT) valve diagnosis, refer to Section 3.
	o Vacuum leak at EVP sensor.	o Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	o Curb idle speed too high or low.	o Reset according to Section 4.
	o Ignition timing too low.	o Reset to specification shown on emission decal.

CA9173-B

Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
• Engine stalls at idle — hot	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• Blocked or restricted EGR passages in valve or spacer.	• Clean passages in EGR spacer and if necessary, replace EGR valve.
	• Load control (WOT) valve malfunction.	• Perform load control (WOT) valve diagnosis, refer to Section 3.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Curb idle speed too high or low.	• Reset according to Section 4.
	• Ignition timing too low.	• Reset to specification shown on emission decal.
• Low power at wide open throttle	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• Blocked or restricted EGR passages in valve or spacer.	• Clean passages in EGR spacer and if necessary, replace EGR valve.
	• Load control (WOT) valve malfunction.	• Perform load control (WOT) valve diagnosis, refer to Section 3.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Ignition timing too low.	• Reset to specification shown on emission decal.

CA9174-B

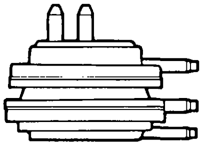
Diagnosis By Symptom

SYMPTOM	POSSIBLE CAUSE	ACTION
• Engine starts but will not run — engine hard to start or will not start	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR, VCV or TVS malfunction.	• Perform EGR, VCV or TVS diagnosis, refer to Section 3.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
• Poor fuel economy	• EGR valve malfunction.	• Perform EGR valve diagnosis.
	• BVT malfunction.	• Perform BVT diagnosis.
	• EGR flange gasket leaking.	• Replace flange gasket and tighten valve attaching nuts or bolts to specification.
	• EGR valve attaching nuts or bolts loose or missing.	• Replace flange gasket and tighten attaching nuts or bolts to specification.
	• EGR, PVS or TVS malfunction.	• Perform EGR, PVS or TVS diagnosis, refer to Section 3.
	• Blocked or restricted EGR passages in valve or spacer.	• Clean passages in EGR spacer and if necessary, replace EGR valve.
	• Load control (WOT) valve malfunction.	• Perform load control (WOT) valve diagnosis, refer to Section 3.
	• Vacuum leak at EVP sensor.	• Replace O-ring seal and tighten EVP sensor attaching nuts to specification.
	• Insufficient exhaust backpressure to activate valve.	• Check exhaust system for leaks.
	• Ignition timing too low.	• Reset to specification shown on emission decal.

CA9175-A

Functional Diagnosis

BACKPRESSURE VARIABLE TRANSDUCER (BVT) SYSTEM

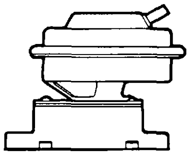


9J431

1. Make certain that all vacuum hoses are correctly routed and securely attached. Replace cracked, crimped or broken hoses.
2. Make certain there is no vacuum to the EGR valve at idle with the engine at normal operating temperature.
3. Install a tachometer, Rotunda 059-00010 or equivalent.
4. Disconnect the Idle Air Bypass Valve (9F715) electrical connector (EFI engines only).
5. Remove vacuum supply hose from the EGR valve nipple. Plug the hose.
6. Start engine, idle with transmission in NEUTRAL, and observe the engine idle speed. If necessary, adjust idle speed according to Section 4.
7. Slowly apply 5-10 inches of mercury vacuum to the EGR valve vacuum nipple using a hand vacuum pump, Rotunda 021-00014 or equivalent.
8. When vacuum is applied to the EGR valve and any of the following occur, replace the valve:
   - Engine does not stall.
   - Idle speed does not drop more than 100 rpm.
   - Idle speed does not return to normal (± 25 rpm) after the vacuum is removed.
9. Reconnect the idle air bypass valve electrical connector.
10. Unplug and reconnect the EGR vacuum supply hose.
11. Disconnect the vacuum connection at the 9J431 Backpressure Variable Transducer (BVT).
12. Gently blow into the hose to Port C until the relief valve closes and at the same time apply 5-10 inches of mercury vacuum to Port E with a hand vacuum pump. Port E should hold vacuum as long as there is pressure on Port C.
13. Apply a minimum of 5-10 inches of mercury vacuum to Ports B and C using a hand vacuum pump. Ports B and C should hold vacuum.
14. Replace the BVT if any of the Ports do not hold vacuum.
15. Reconnect the vacuum at the BVT.
16. If neither the EGR valve nor the BVT were replaced, the system is OK. Refer to the Diagnostic Routine in Section 2.

Functional Diagnosis

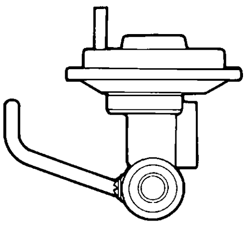
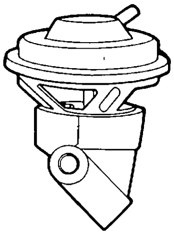
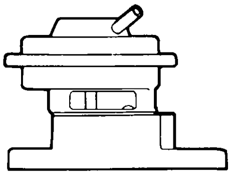
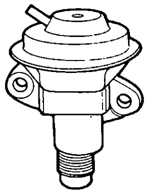
INTEGRAL BACKPRESSUE (IBP) TRANSDUCER EGR VALVE



9D448

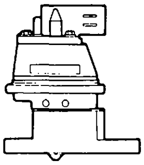
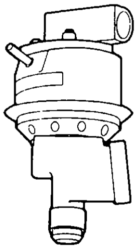
1. Make certain that all vacuum hoses are correctly routed and securely attached. Replace cracked, crimped or broken hoses.
2. Make certain there is no vacuum to the EGR valve at idle with the engine at normal operating temperature.
3. Install a tachometer, Rotunda 059-00010 or equivalent.
4. Plug the tailpipe (s) to increase the exhaust system backpressure, leaving a ½-inch diameter opening to allow exhaust gases to escape.
5. Remove the vacuum supply hose from the EGR valve nipple. Plug the hose.
6. Start engine, idle with transmission in NEUTRAL, and observe idle speed. If necessary, adjust idle speed according to Section 4.
7. Slowly apply 5-10 inches of mercury vacuum to the EGR valve vacuum nipple using a hand vacuum pump, Rotunda 021-00014 or equivalent.
8. When vacuum is applied to the EGR valve and any of the following occur, replace the valve:
   - Engine does not stall.
   - Idle speed does not drop more than 100 rpm.
   - Idle speed does not return to normal (±25 rpm) after the vacuum is removed.
9. If the EGR valve is not replaced, reconnect the idle air bypass valve electrical connector.
10. Unplug and reconnect the EGR vacuum supply hose.
11. Remove the tailpipe plug (s).
12. The EGR system is OK, refer to the Diagnostic Routines in Section 2.

Functional Diagnosis

PORTED EGR VALVE	 **9D460**	 **9D475**	 **9D475**	 **9D475**

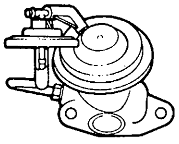
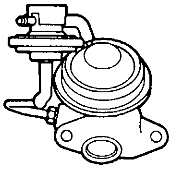
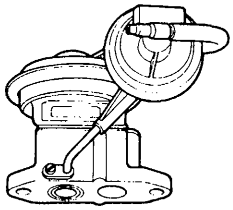
1. Make certain that all vacuum hoses are correctly routed and securely attached. Replace cracked, crimped or broken hoses.
2. Make certain there is no vacuum to the EGR valve at idle with the engine at normal operating temperature.
3. Install a tachometer, Rotunda 059-00010 or equivalent.
4. Disconnect the Idle Air Bypass Valve (9F715) electrical connector (EFI engines only).
5. Remove the vacuum supply hose from the EGR valve nipple, Plug the hose.
6. Start engine, idle with transmission in NEUTRAL, and observe the engine idle speed. If necessary, adjust idle speed according to Section 4.
7. Slowly apply 5-10 inches of mercury vacuum to the EGR valve vacuum nipple using a hand *vacuum pump, Rotunda 021-00014 or equivalent.*
8. When vacuum is applied to the EGR valve and any of the following occur, replace the valve:
   - Engine does not stall.
   - Idle speed does not drop more than 100 rpm.
   - Idle speed does not return to normal (±25 rpm) after the vacuum is removed.
9. Reconnect the idle air bypass valve electrical connector.
10. Unplug and reconnect the EGR vacuum supply hose.
11. The EGR system is OK, refer to the Diagnostic Routines in Section 2.

Functional Diagnosis

ELECTRONIC EGR (EEGR) VALVE	 9F483	 9F483

1. Make certain that all vacuum hoses are correctly routed and securely attached. Replace cracked, crimped or broken hoses.
2. Make certain there is no vacuum to the EGR valve at idle with the engine at normal operating temperature.
3. Install a tachometer, Rotunda 059-00010 or equivalent.
4. Disconnect the Idle Air Bypass Valve (9F715) electrical connector (EFI engines only).
5. Remove the vacuum supply hose from the EGR valve nipple. Plug the hose.
6. Disconnect the 9G428 EVP sensor electrical connector mounted on top of the 9H473 valve.
7. Start engine, idle with transmission in NEUTRAL, and observe the engine idle speed. If necessary, adjust idle speed according to Section 4.
8. Slowly apply 5-10 inches of mercury vacuum to the EGR valve vacuum nipple using a hand vacuum pump, Rotunda 021-00014 or equivalent.
9. When vacuum is applied to the EGR valve and any of the following occur, replace the valve:
   - Engine does not stall.
   - Idle speed does not drop more than 100 rpm.
   - Idle speed does not return to normal (±25 rpm) after the vacuum is removed.
10. Reconnect the idle air bypass valve electrical connector.
11. Unplug and reconnect the EGR vacuum supply hose.
12. Reconnect the EVP sensor electrical connector.
13. The EGR system is OK, refer to the Diagnostic Routines in Section 2.

Functional Diagnosis

VALVE AND TRANSDUCER ASSEMBLY	 **9H495**	 **9H495**	 **9H495**

1. Make certain that all vacuum hoses are correctly routed and securely attached. Replace cracked, crimped or broken hoses.
2. Make certain there is no vacuum to the EGR valve at idle with the engine at normal operating temperature.
3. Install a tachometer, Rotunda 059-00010 or equivalent.
4. Plug the tailpipe (s) to increase the exhaust system backpressure, leaving a ½-inch diameter opening to allow exhaust gases to escape.
5. Remove the vacuum supply hose from the exhaust backpressure transducer nipple and plug the hose. Do not disconnect the transducer from the EGR valve.
6. Start engine, idle with transmission in NEUTRAL, and observe the engine idle speed. If necessary, adjust idle speed according to Section 4.
7. Slowly apply 5-10 inches of mercury vacuum to the Backpressure Transducer vacuum nipple using a hand vacuum pump, Rotunda 021-00014 or equivalent.
8. When vacuum is applied to the Backpressure Transducer and any of the following occur, replace the valve:
   - Engine does not stall.
   - Idle speed does not drop more than 100 rpm.
   - Idle speed does not return to normal (±25 rpm) after the vacuum is removed.
9. Unplug and reconnect the vacuum supply hose to the exhaust backpressure transducer.
10. Remove the tailpipe plug (s).
11. The EGR system is OK, refer to the Diagnostic Routines in Section 2.

OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS

ORDERING INFORMATION
A special order form is included in the back of this manual for your convenience if you desire to order.

ENGINE EMISSIONS FACTS BOOK

- The manual contains complete specifications for each calibration number.
- Published at the conclusion of the model year.

ELECTRICAL & VACUUM TROUBLESHOOTING MANUAL (EVTM)

- Available for all passenger car and light truck vehicles, this publication provides schematics of all electrical and vacuum circuits. Wiring diagrams show how the circuit is powered. Troubleshooting hints are provided to point the technician in a general direction but are not step by step procedures.
- Available in the first quarter of the model year. (One manual for each passenger car and light truck family.)

WIRING & VACUUM DIAGRAMS

- This publication contains wiring diagrams for all Ford and Lincoln/Mercury passenger car and light truck vehicles. A Power Distribution system illustrates the power distribution throughout each vehicle. In addition, all individual electrical circuits are shown for each vehicle line.
- Available in the first quarter of the model year.

Service Specifications Manuals

(CAR AND TRUCK)

- These manuals contain all specifications including maintenance and lubrication contained in the Shop Manuals in a handy pocket size for easy reference.
- Available in the first quarter of the model year.

SECTION 7

Evaporative Emission Systems

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SECTION 7

Evaporative Emission Systems

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Evaporative Emission Systems

DESCRIPTION

Fuel Tank Venting

Fuel vapors trapped in the sealed fuel tank are vented through the orificed, vapor valve assembly in the top of the tank. The vapors leave the valve assembly through a single vapor line and continue to the carbon canister (located in the engine compartment or along the frame rail), for storage, until such time as they are purged to the engine for burning.

Carburetor Venting

Carburetor and air cleaner vapors are vented to the carbon canister when the engine is stopped. Vapor flow is controlled by a carburetor fuel bowl solenoid vent valve, thermal vent valve, or vacuum thermal bowl vent valve. After the engine is started, vapors are drawn into the combustion chamber for burning. Vapor flow from the carbon canister to the engine is controlled by the canister purge solenoid or the canister purge valve, depending on the engine calibration.

Typical storage and return systems for fuel vapors are shown in Figures 1 through 38.

NOTE: To ensure efficient flow of vapors, the line from the carburetor bowl should have a continuous downhill slope to the canister.

On most applications the canister is purged by drawing the vapors into the intake manifold. On other engines vapors are drawn into the air cleaner.

DIAGNOSIS

Refer to individual components, Section 3.

Evaporative Emission Systems

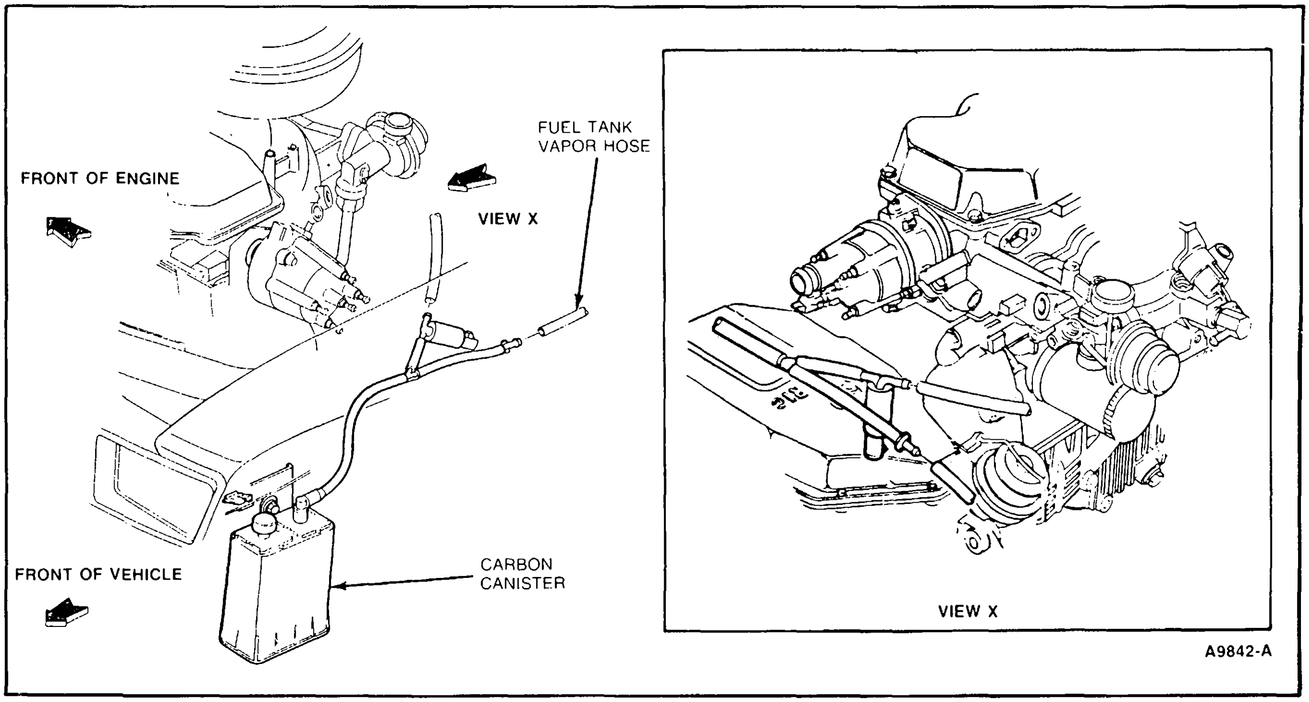


Figure 1 Typical 1.9L CFI Escort/Lynx, EXP—Evaporative Emission System

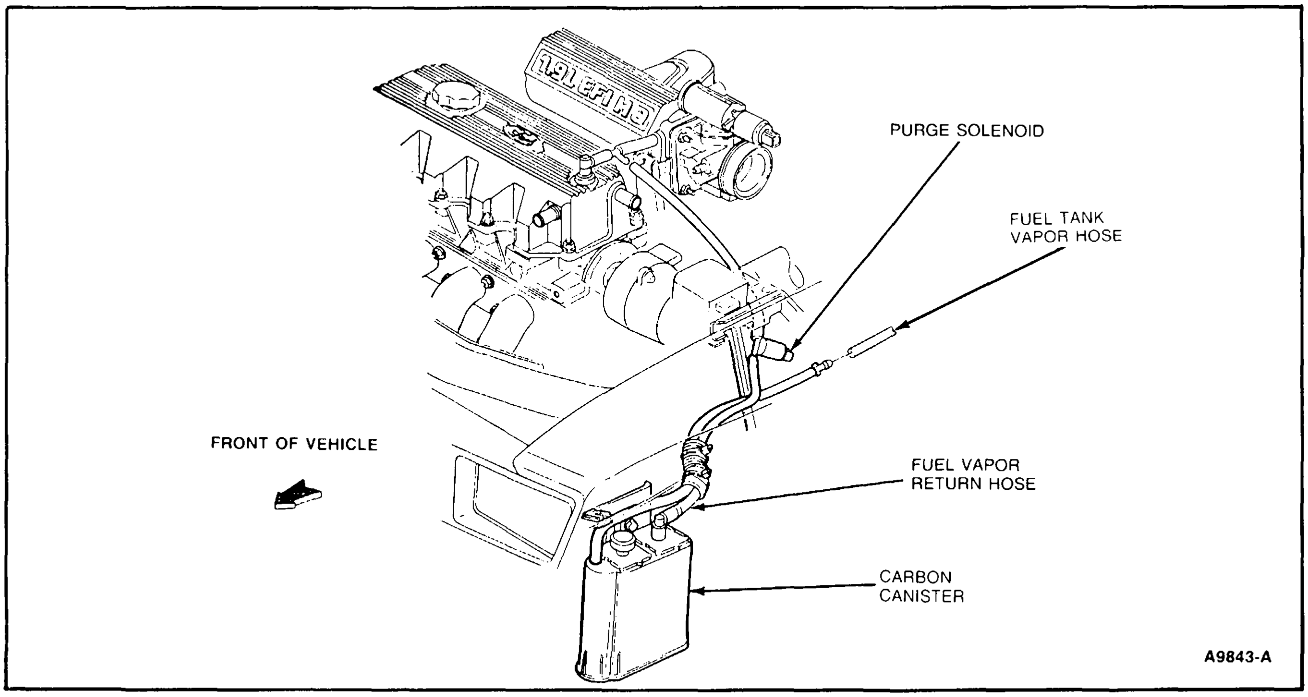


Figure 2 Typical 1.9L EFI Escort/Lynx, EXP—Evaporative Emission System

Evaporative Emission Systems

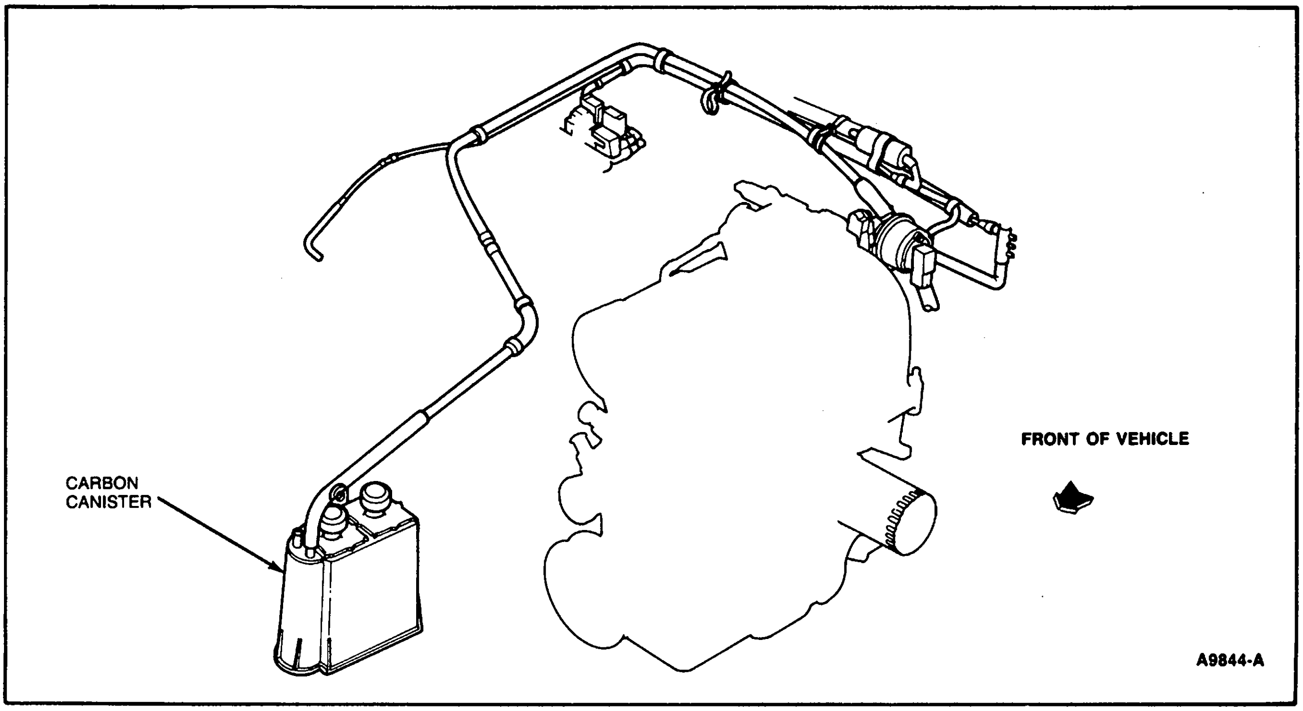


Figure 3 Typical 2.3L EFI Mustang, 50 States Canada—Evaporative Emission System

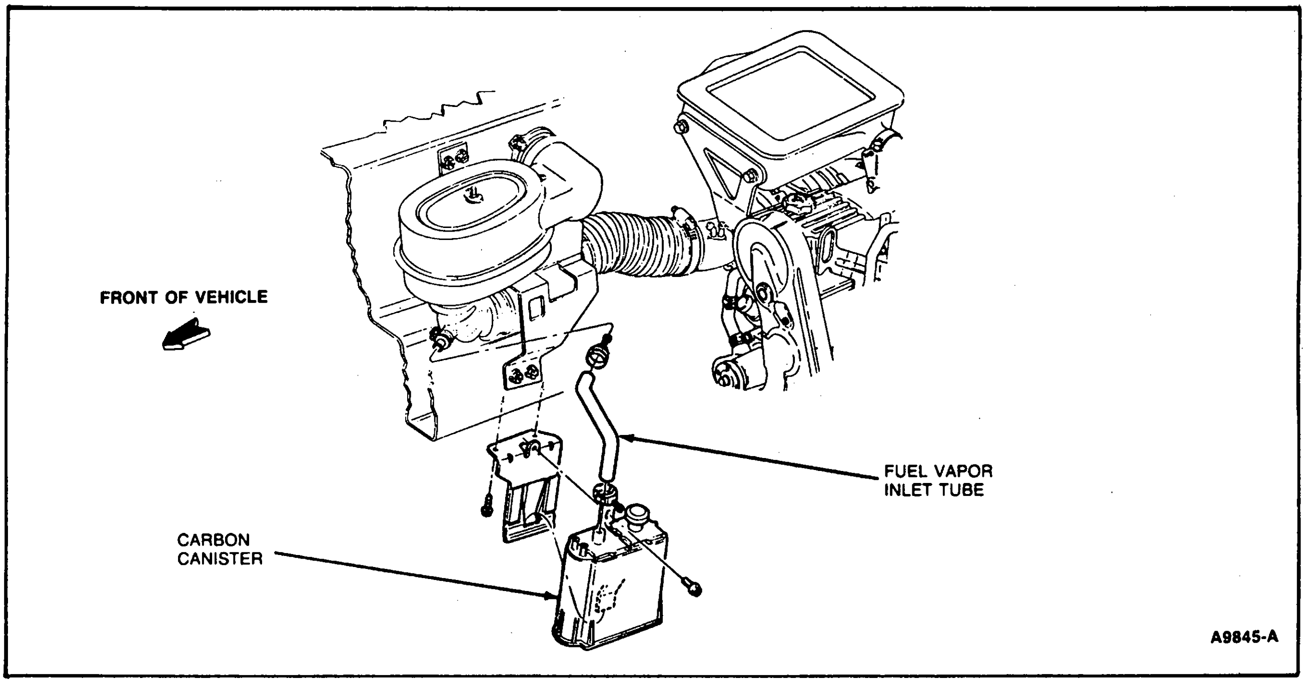


Figure 4 Typical 2.3L OHC EFI Turbo Thunderbird—Evaporative Emission System

Evaporative Emission Systems

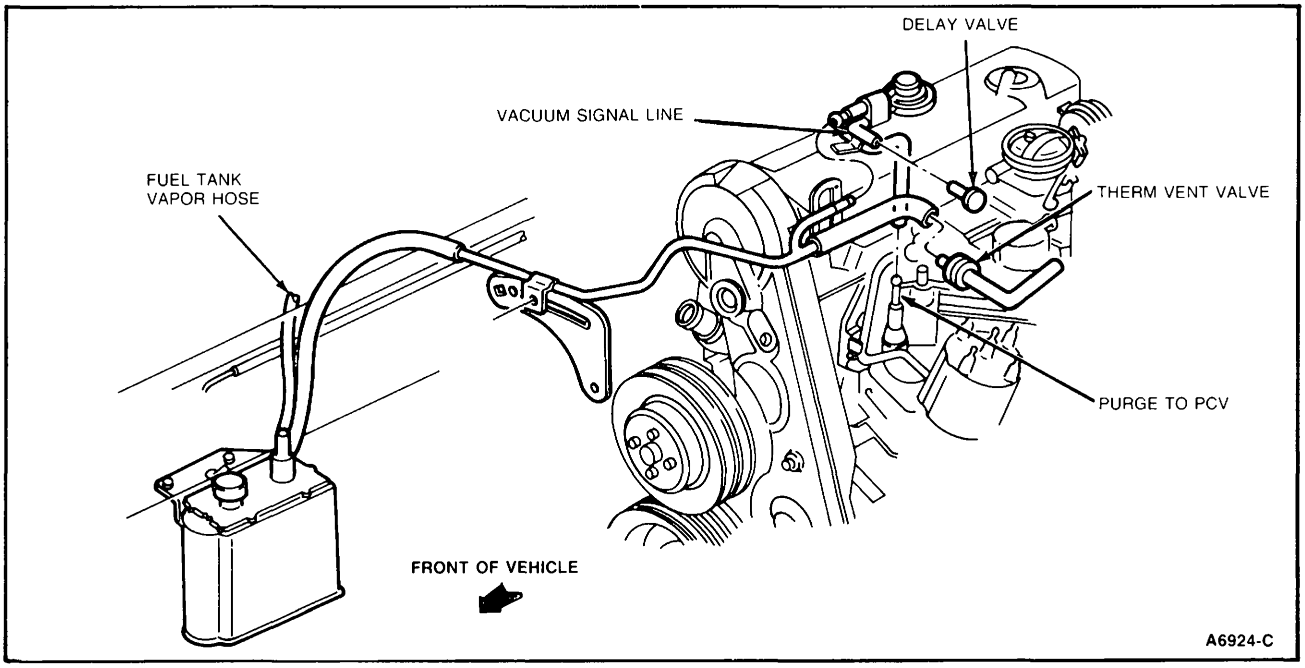


Figure 5 Typical 2.3L OHC Passenger Car, Canada (Carbureted Only)—Evaporative Emission System

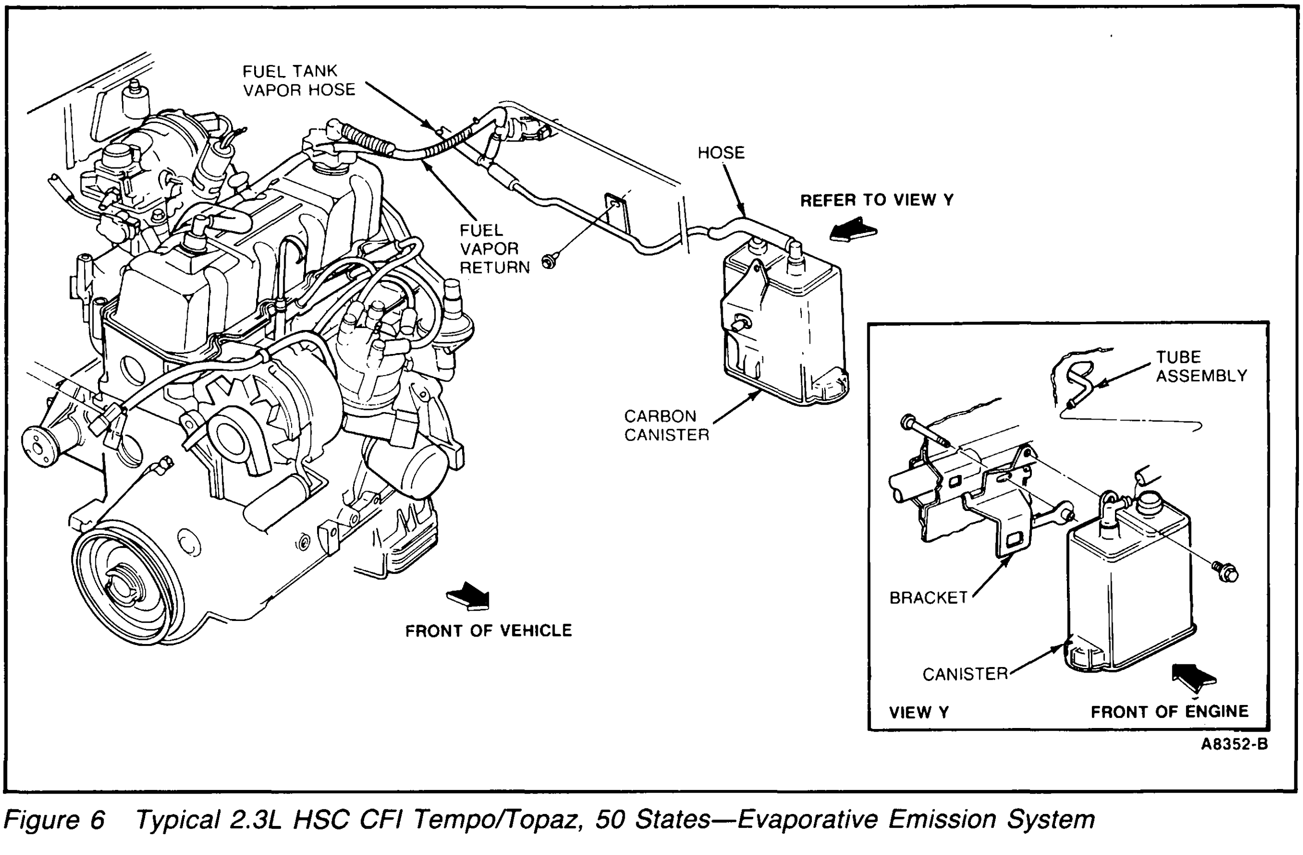


Figure 6 Typical 2.3L HSC CFI Tempo/Topaz, 50 States—Evaporative Emission System

Evaporative Emission Systems

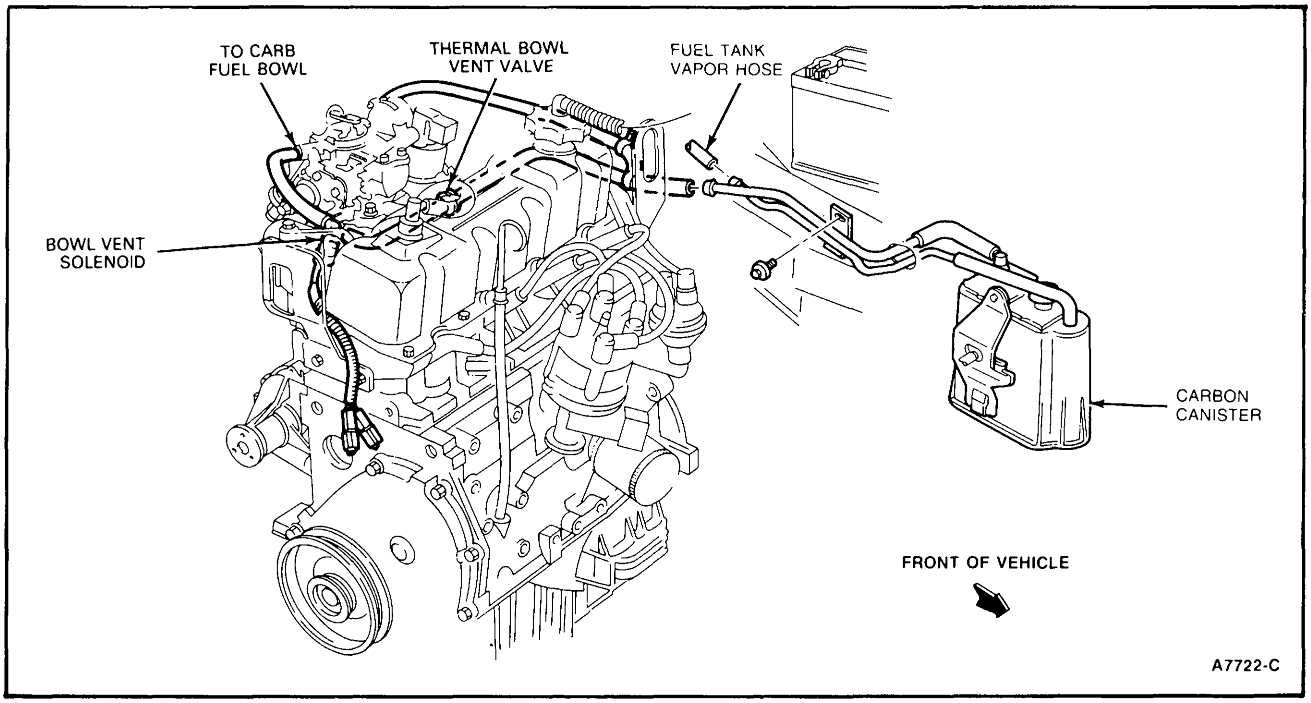


Figure 7 Typical 2.3L HSC Passenger Car, Canada (Carbureted Only)—Evaporative Emission System

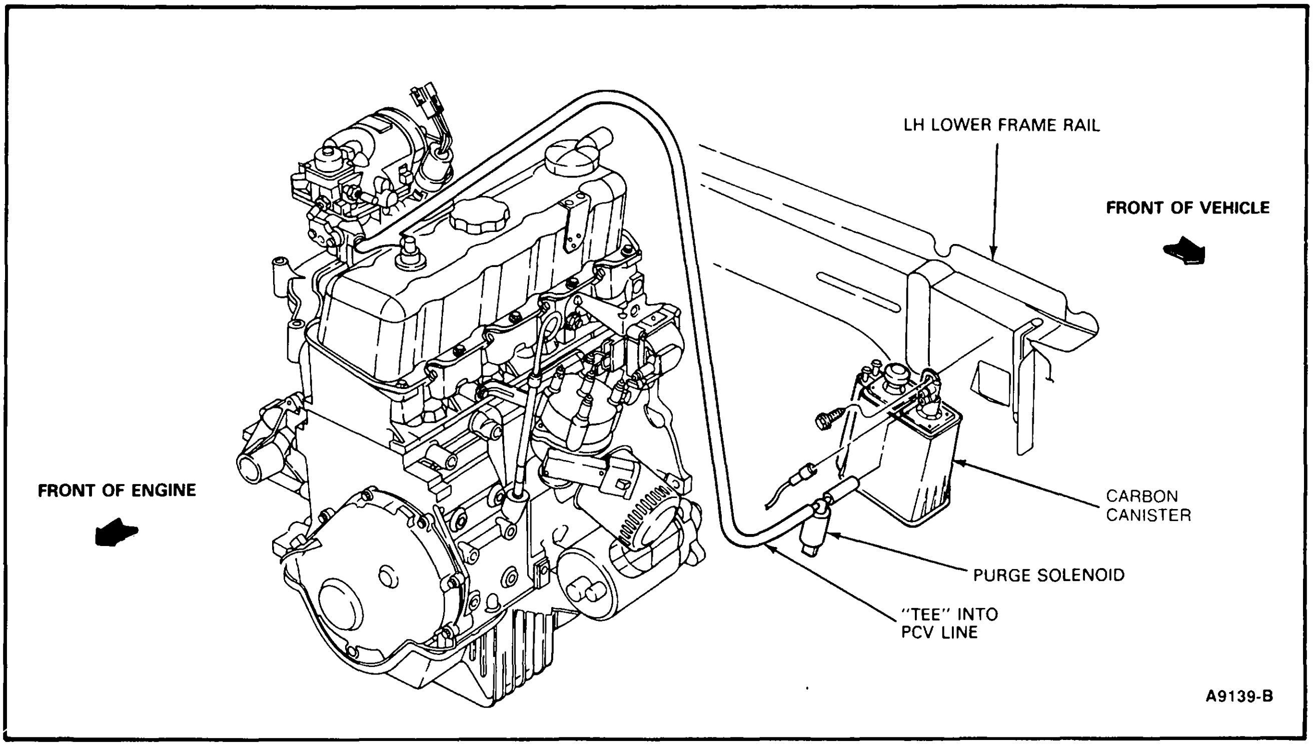


Figure 8 Typical 2.5L CFI HSC Taurus/Sable, 50 States and Canada—Evaporative Emission System

Evaporative Emission Systems

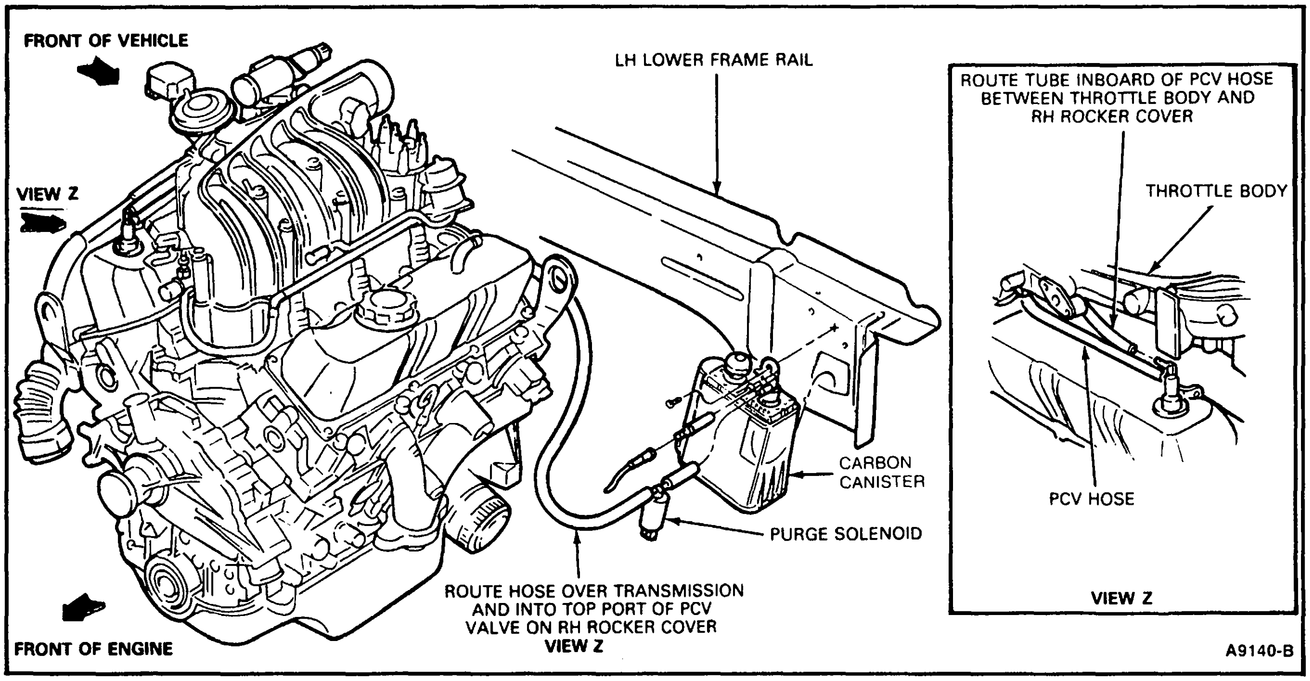

FRONT OF VEHICLE
VIEW Z
LH LOWER FRAME RAIL
ROUTE TUBE INBOARD OF PCV HOSE BETWEEN THROTTLE BODY AND RH ROCKER COVER
THROTTLE BODY
CARBON CANISTER
PURGE SOLENOID
PCV HOSE
VIEW Z
ROUTE HOSE OVER TRANSMISSION AND INTO TOP PORT OF PCV VALVE ON RH ROCKER COVER
VIEW Z
FRONT OF ENGINE
A9140-B

Figure 9 Typical 3.0L EFI Taurus/Sable, 50 States and Canada—Evaporative Emission System

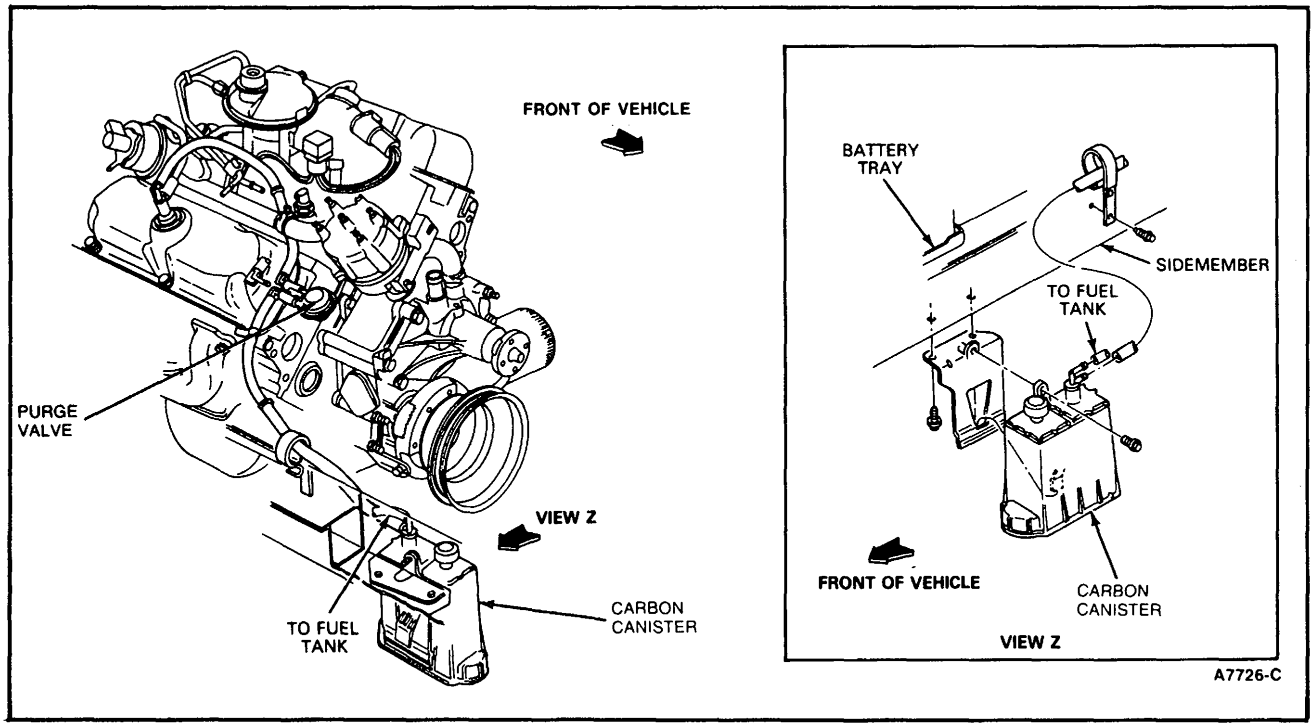


Figure 10 Typical 3.8L CFI Thunderbird/Cougar, Mustang, 50 States—Evaporative Emission System

Evaporative Emission Systems

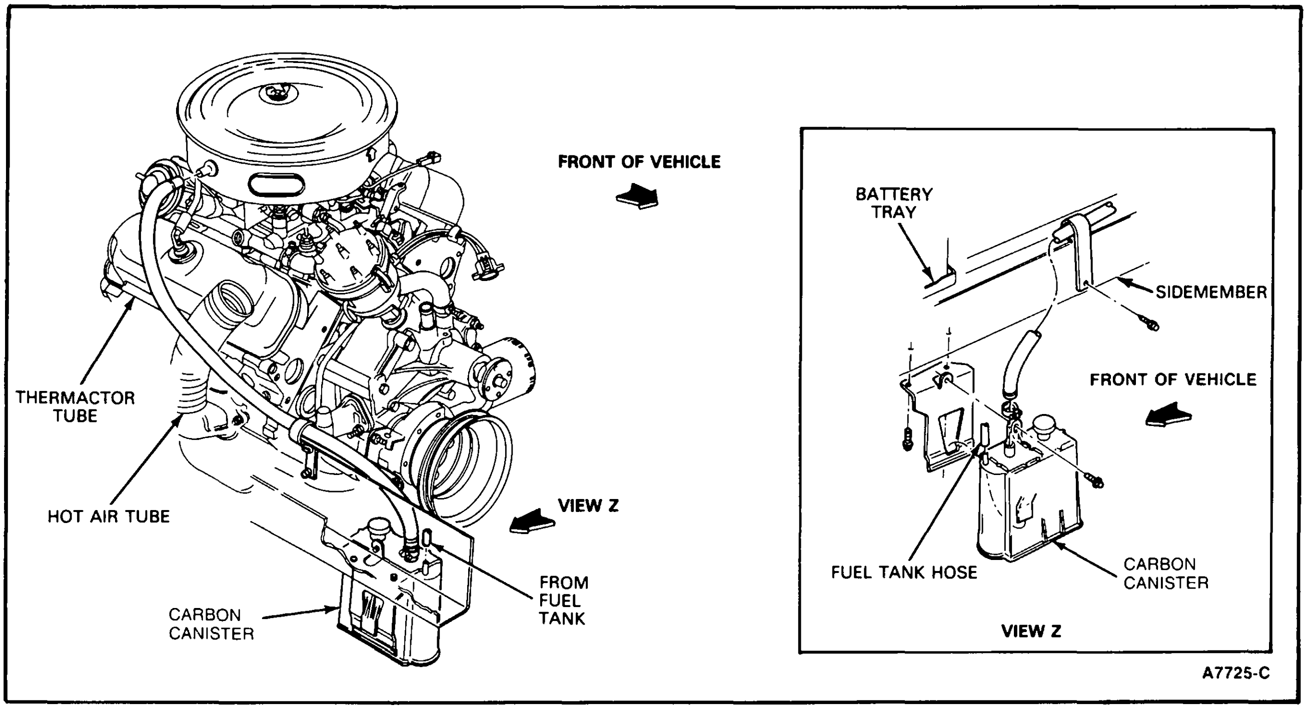
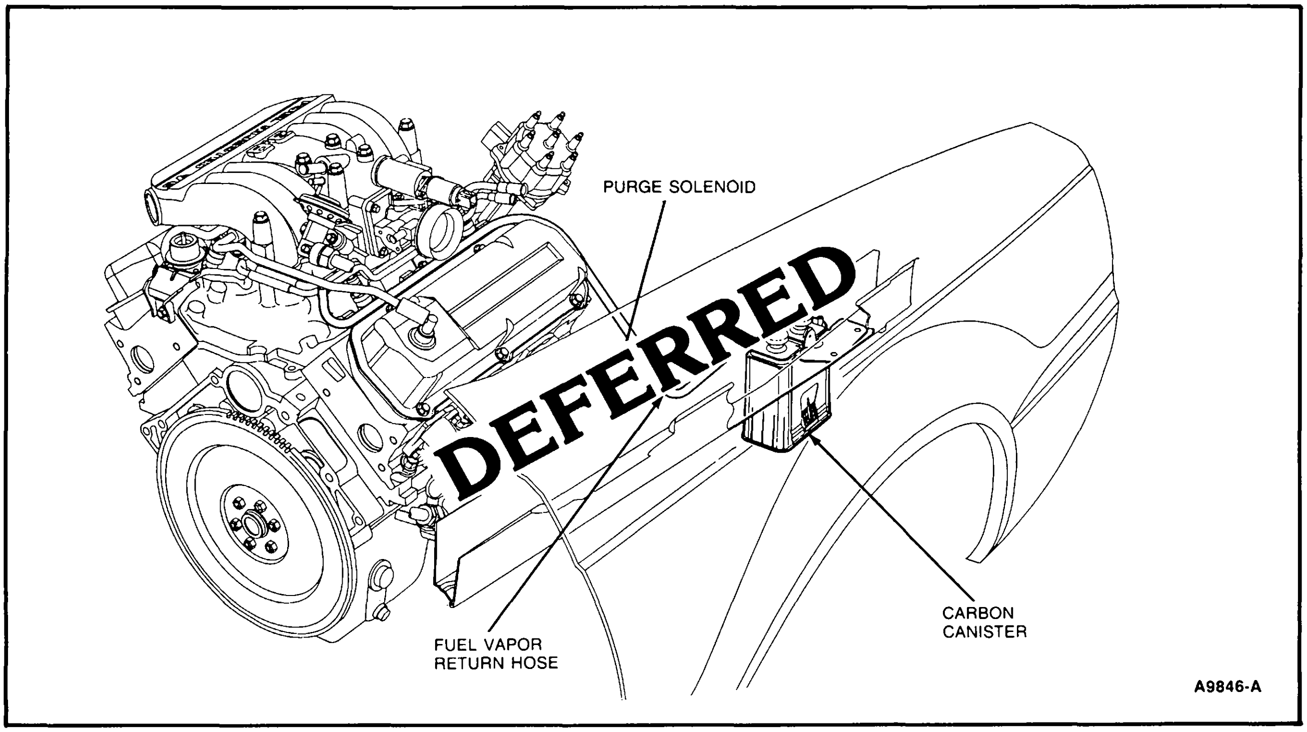


Figure 11 Typical 3.8L-2V Thunderbird/Cougar, Canada (Carbureted Only)—Evaporative Emission System



DEFERRED

Figure 12 Typical 3.8L-EFI Thunderbird/Cougar, 50 States, Altitude and Canada—Evaporative Emission System

Evaporative Emission Systems

3.8L EFI Taurus/Sable
1987½
Available At A Later
Printing

DEFERRED

Figure 13 Typical 3.8L-EFI Taurus/Sable, 50 States—Evaporative Emission System

Evaporative Emission Systems

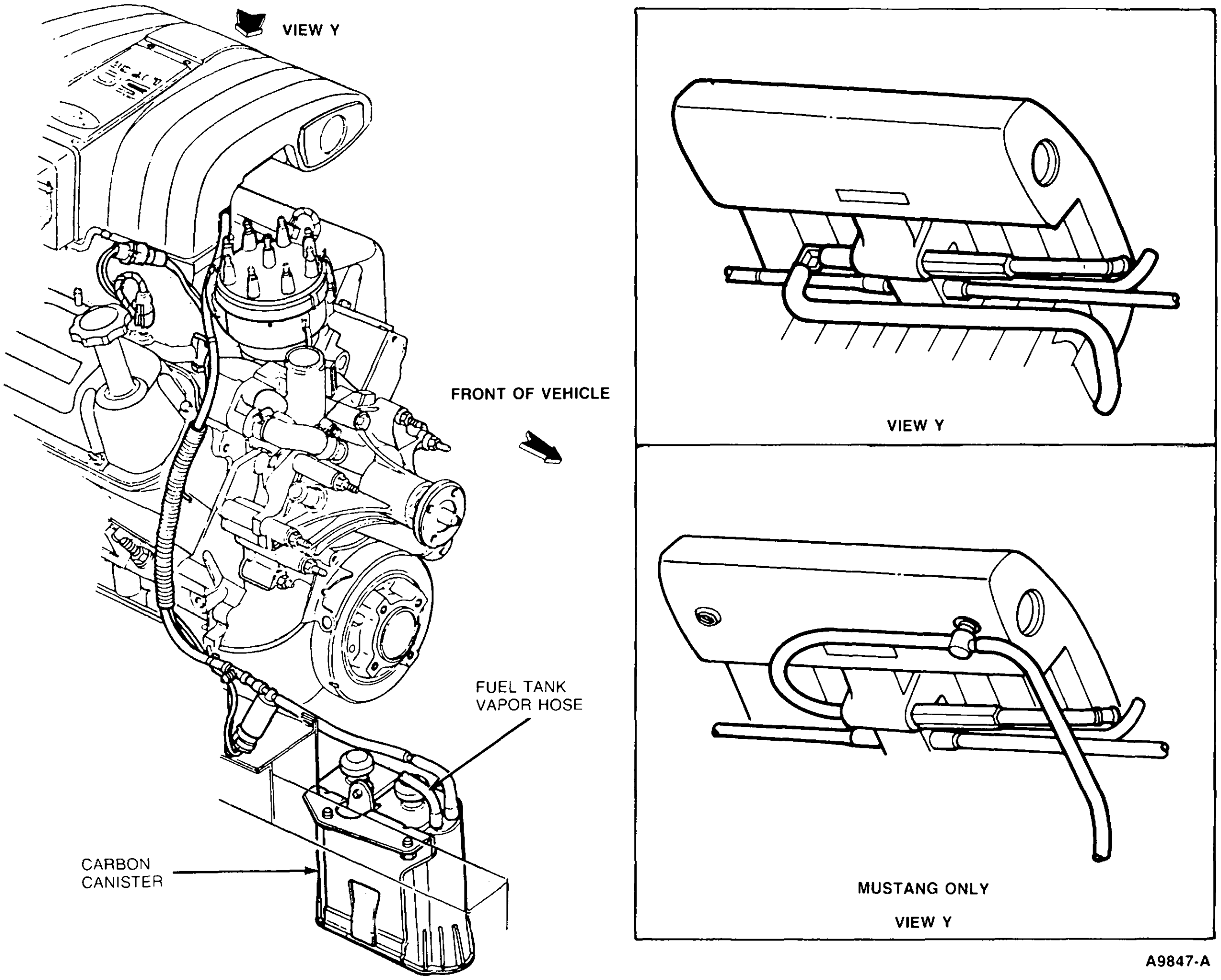


Figure 14 Typical 5.0L SEFI, HO SEFI, Continental/Mark VII, Thunderbird/Cougar, Mustang, Mark LSC, 50 States and Canada—Evaporative Emission System

Evaporative Emission Systems

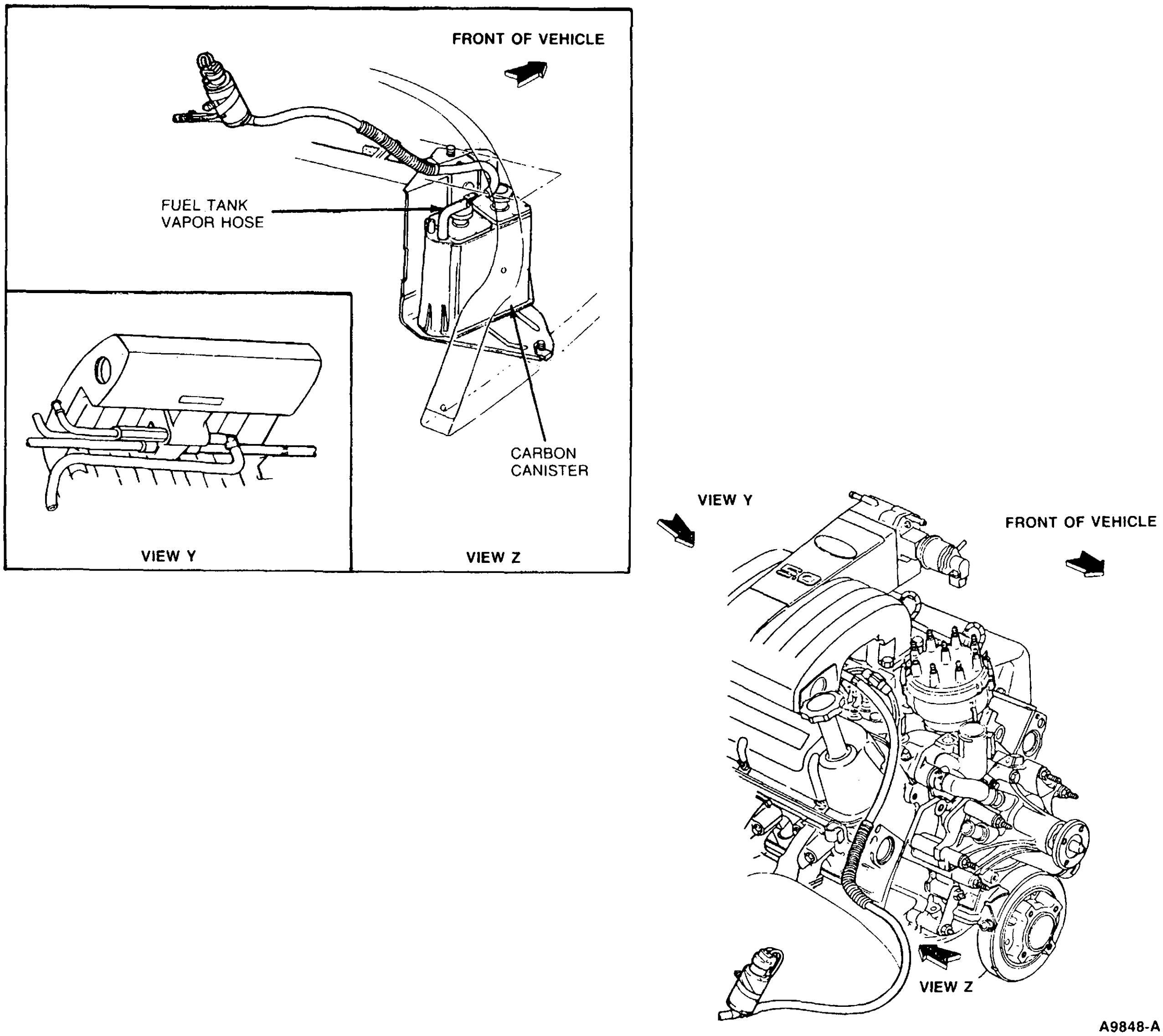


Figure 15 Typical 5.0L SEFI, Ford/Mercury, Lincoln Town Car, 50 States, Altitude and Canada—Evaporative Emission System

Evaporative Emission Systems

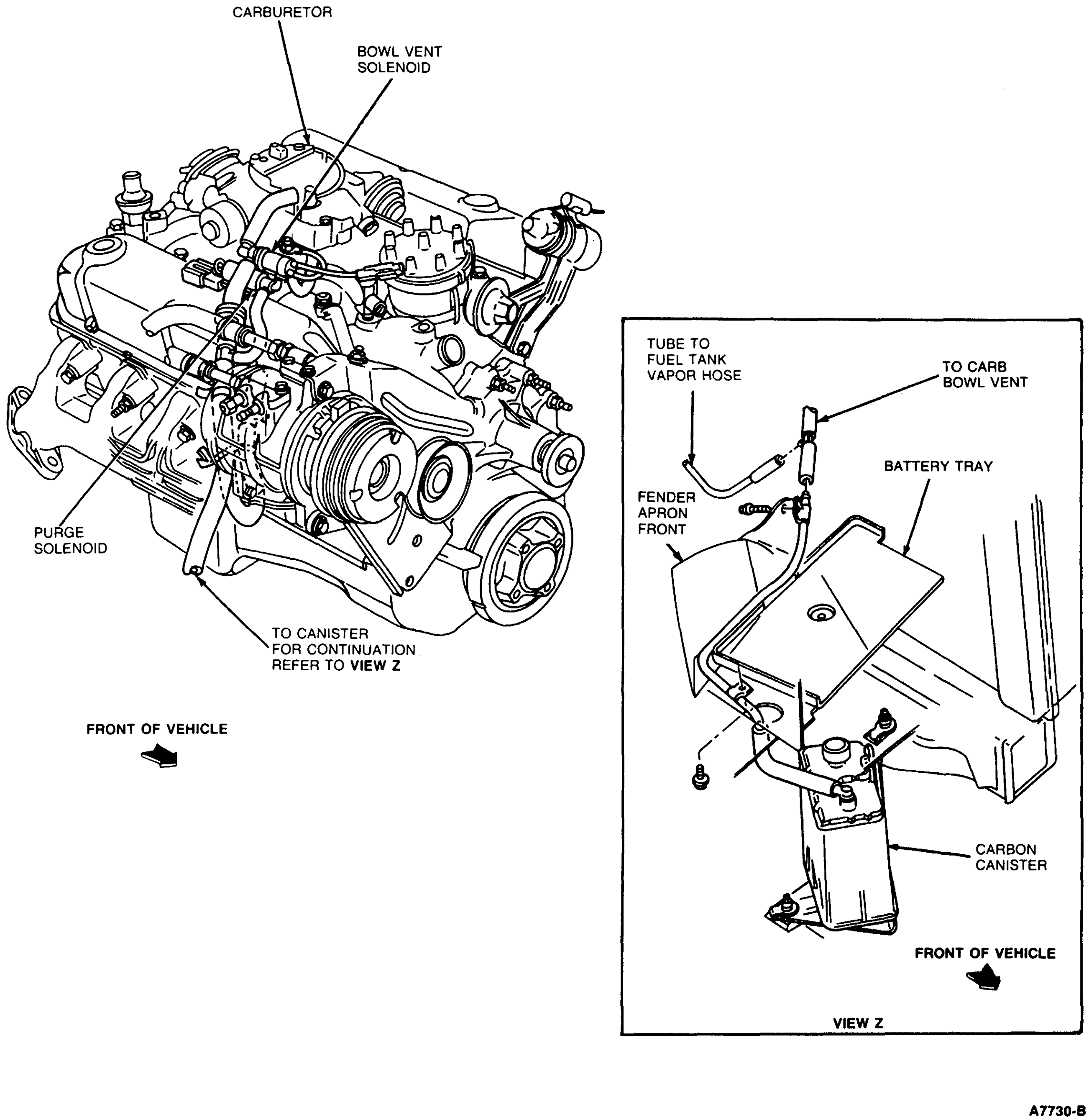


Figure 16 Typical 5.8L 50 States Police Intercepter Package (Ford/Mercury), Canadian Towing Package (Carbureted Only)—Evaporative Emission System

Evaporative Emission Systems

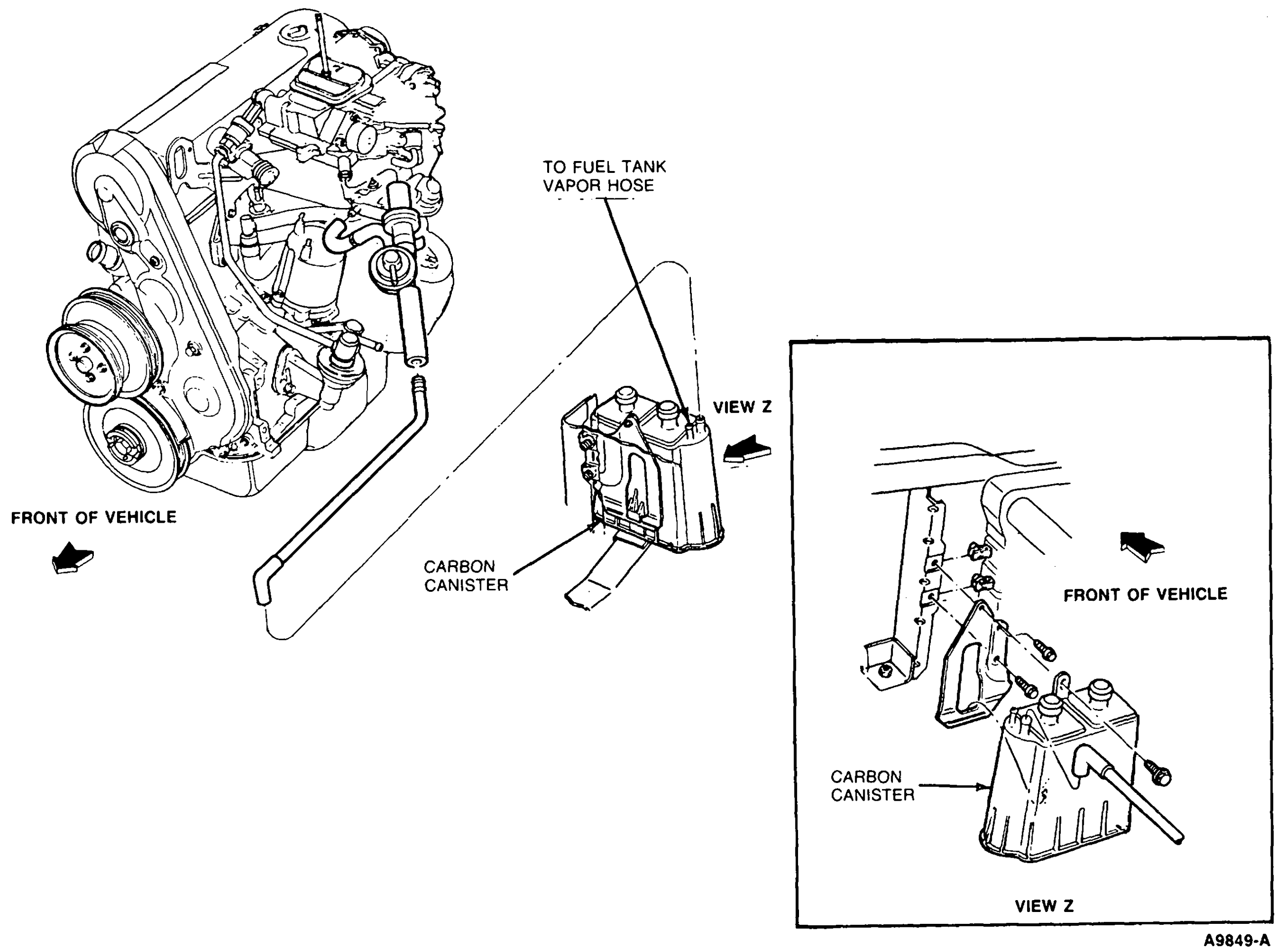


Figure 17 Typical 2.0L Ranger, 49 States (Carbureted Only)—Evaporative Emission System

Evaporative Emission Systems

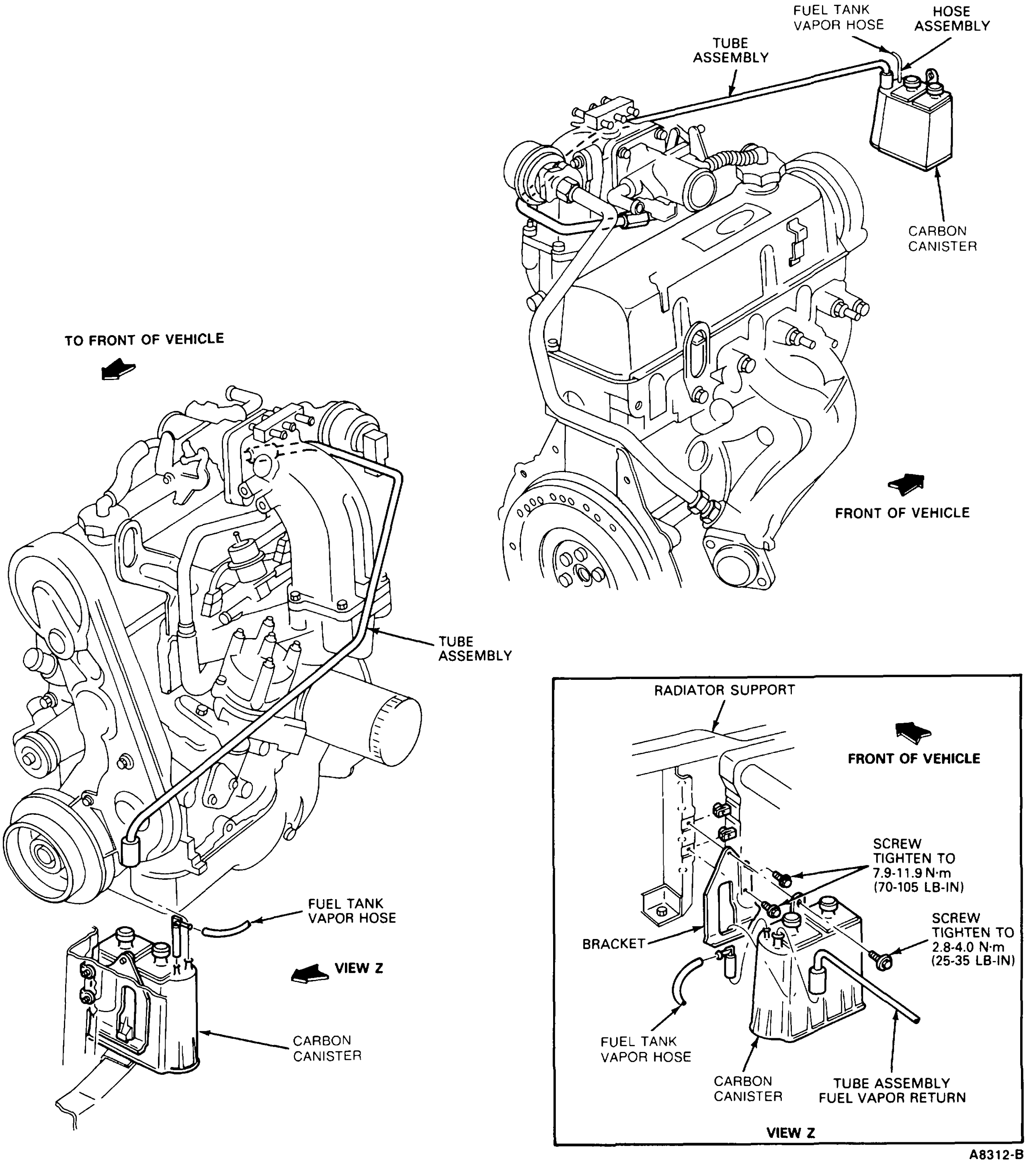


Figure 18 Typical 2.3L EFI Ranger/Bronco II—Evaporative Emission System

Evaporative Emission Systems

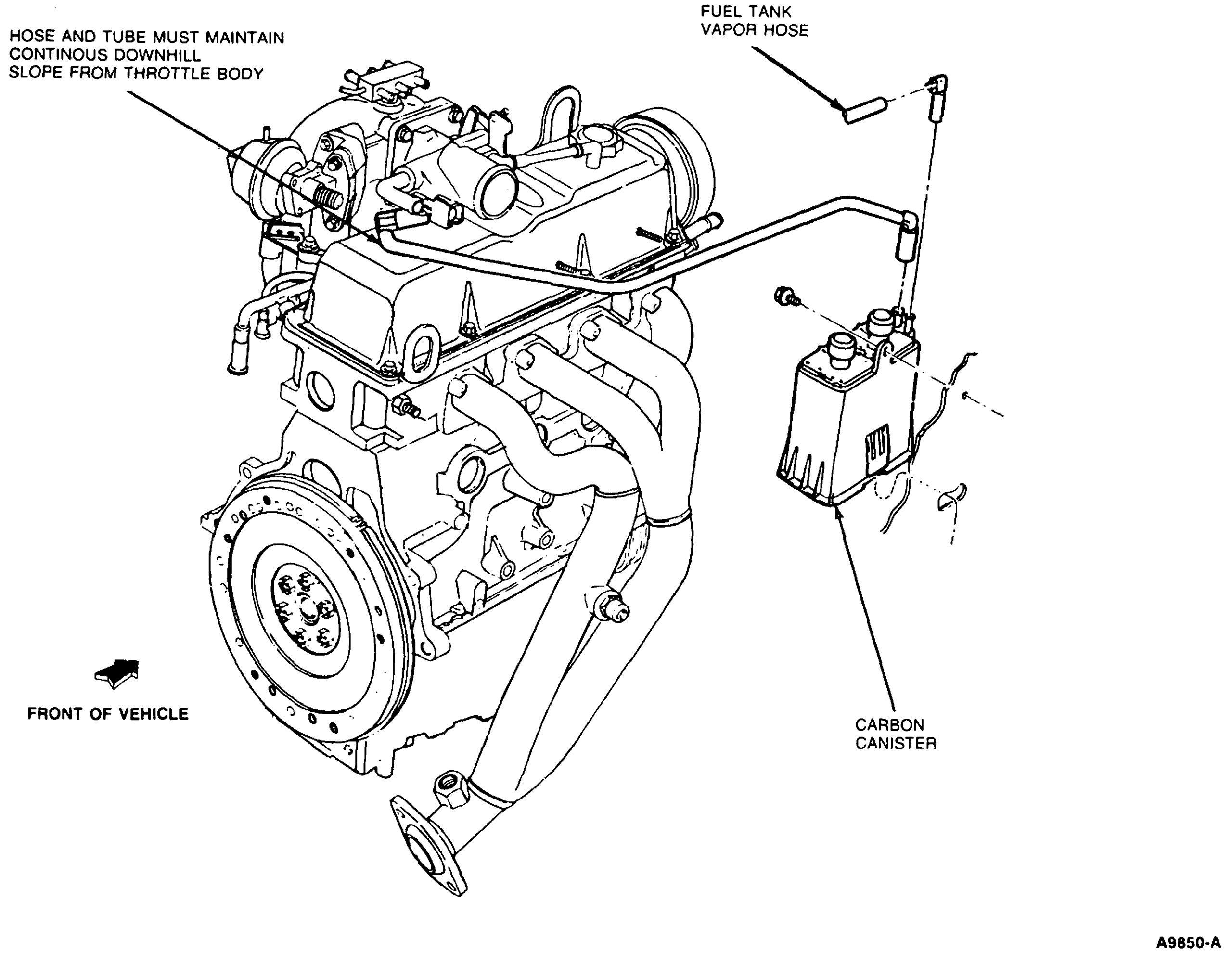

HOSE AND TUBE MUST MAINTAIN CONTINOUS DOWNHILL SLOPE FROM THROTTLE BODY
FUEL TANK VAPOR HOSE
FRONT OF VEHICLE
CARBON CANISTER
A9850-A

Figure 19 Typical 2.3L EFI Aerostar—Evaporative Emission System

Evaporative Emission Systems

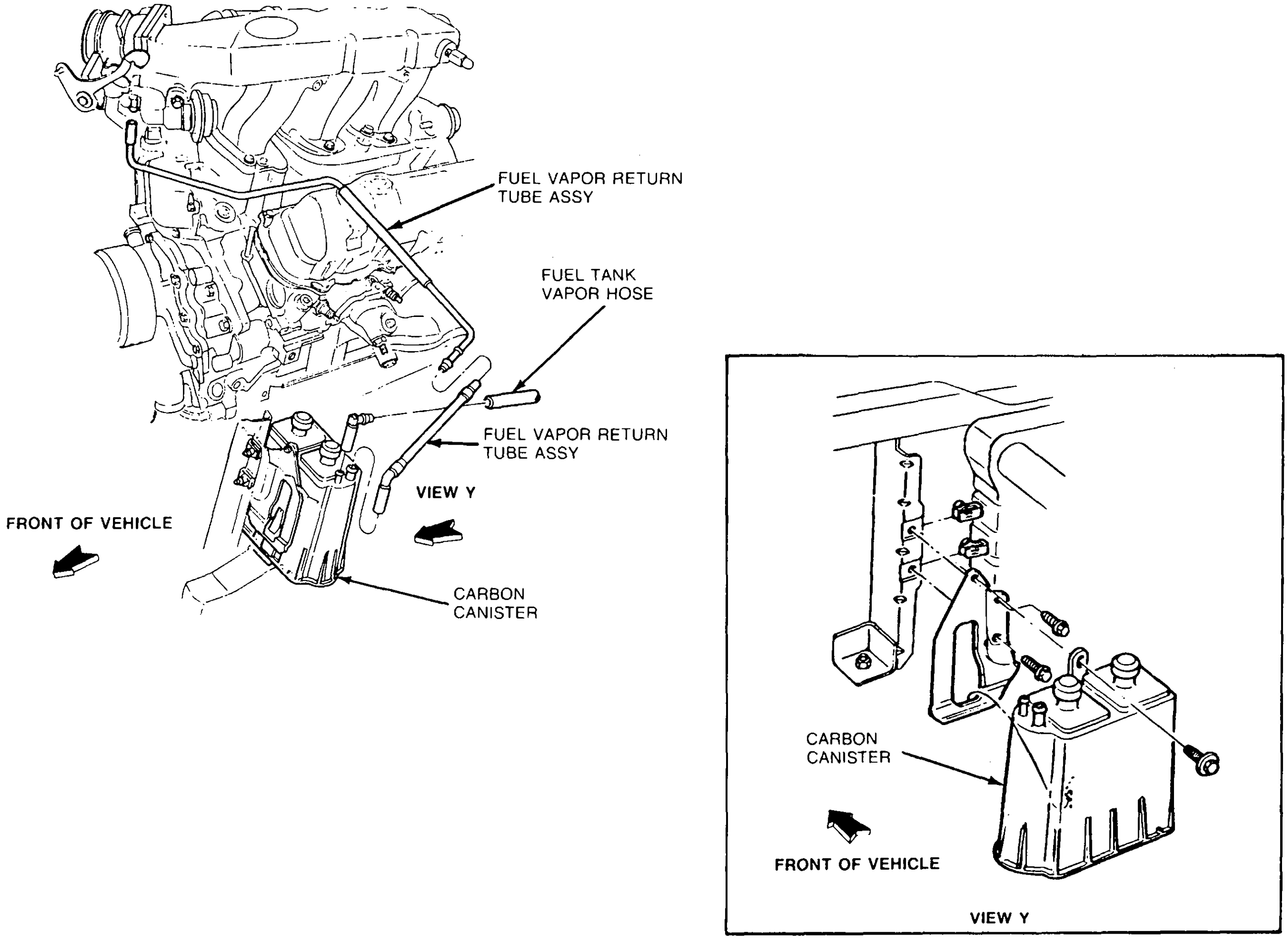


Figure 20 Typical 2.9L EFI, Ranger/Bronco II, 50 States and Canada—Evaporative Emission System

Evaporative Emission Systems

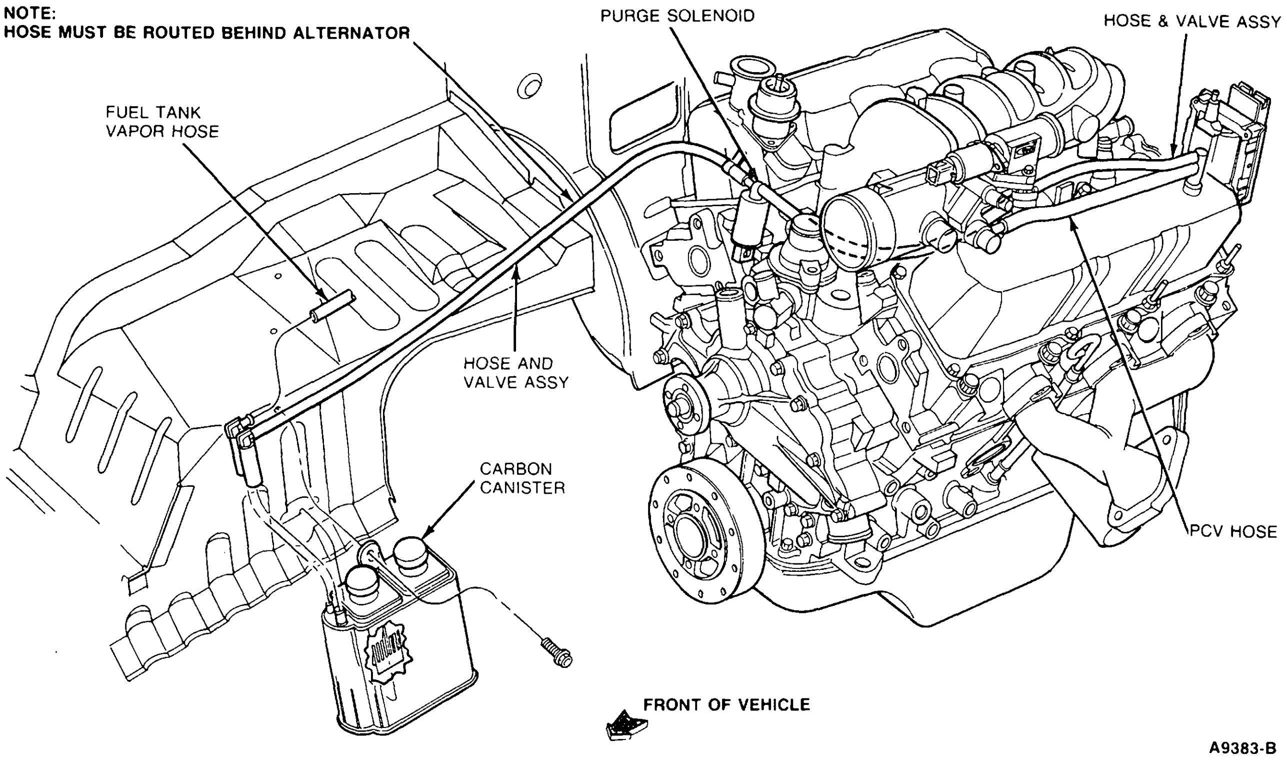


Figure 21 Typical 3.0L EFI, Aerostar—Evaporative Emission System

Evaporative Emission Systems

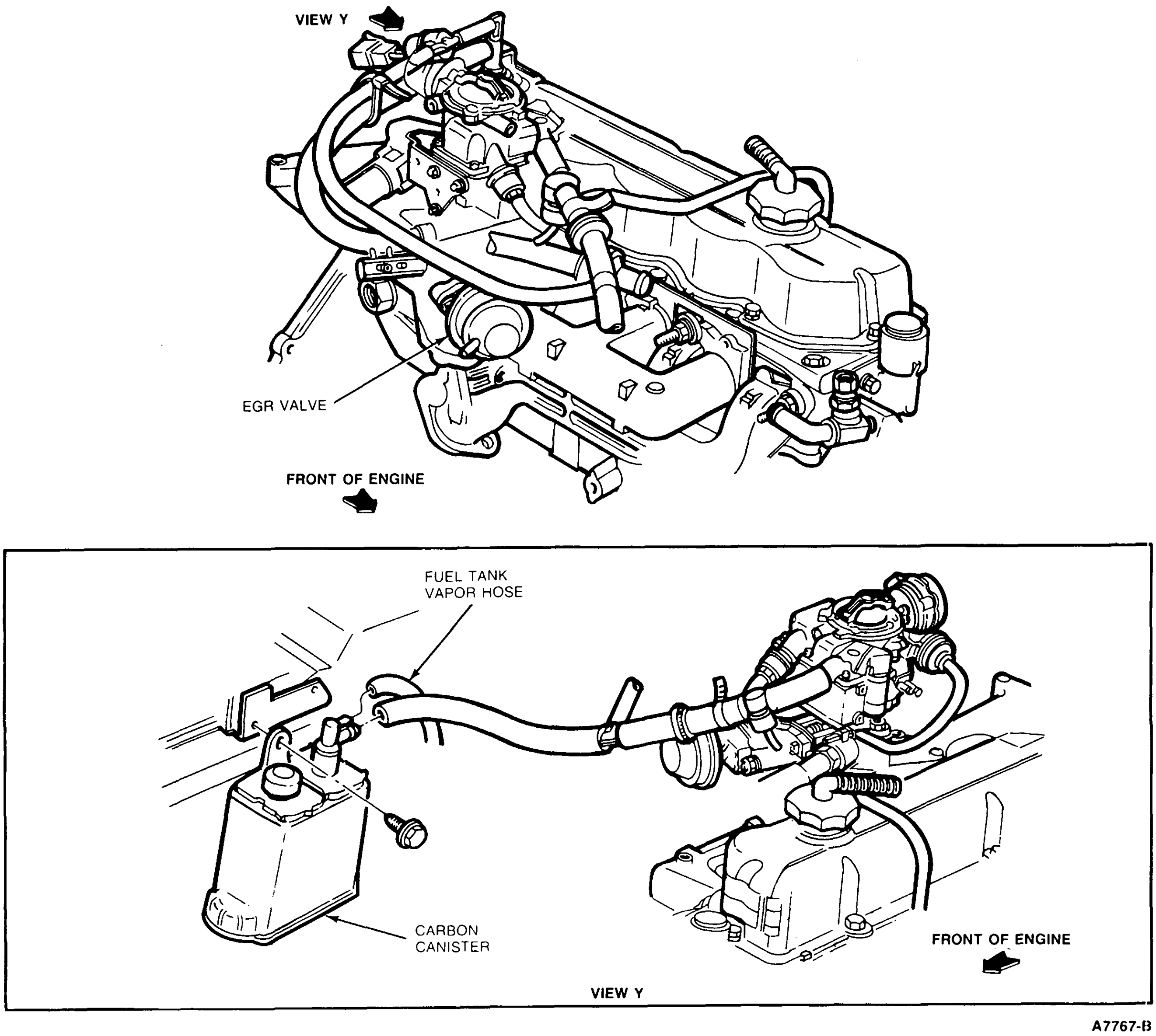


Figure 22 Typical 4.9L F-Series/Bronco (Carbureted Only)—Evaporate Emission System

Evaporative Emission Systems

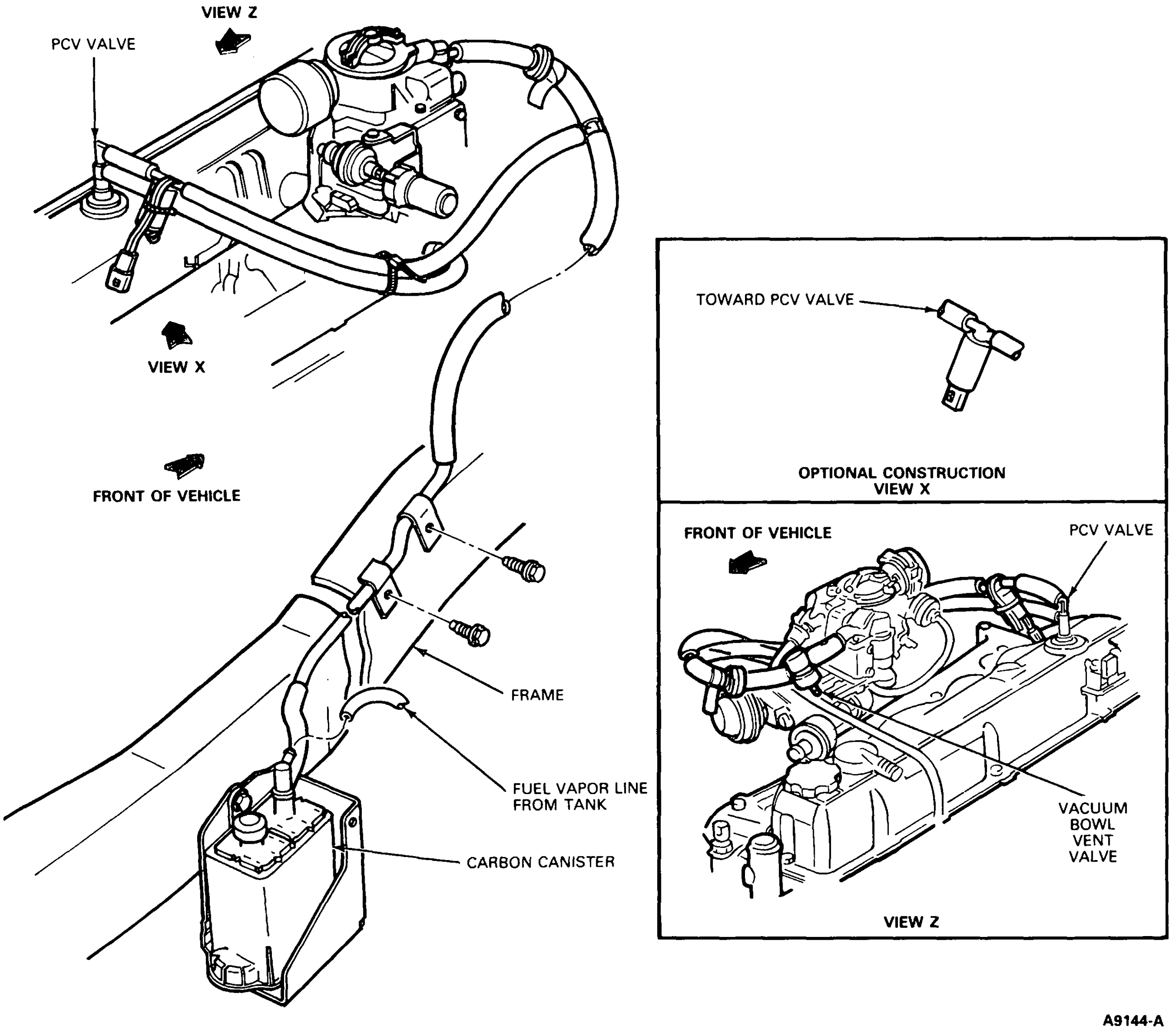


Figure 23 Typical 4.9L E-Series (Carbureted Only)—Evaporative Emission System

Evaporative Emission Systems

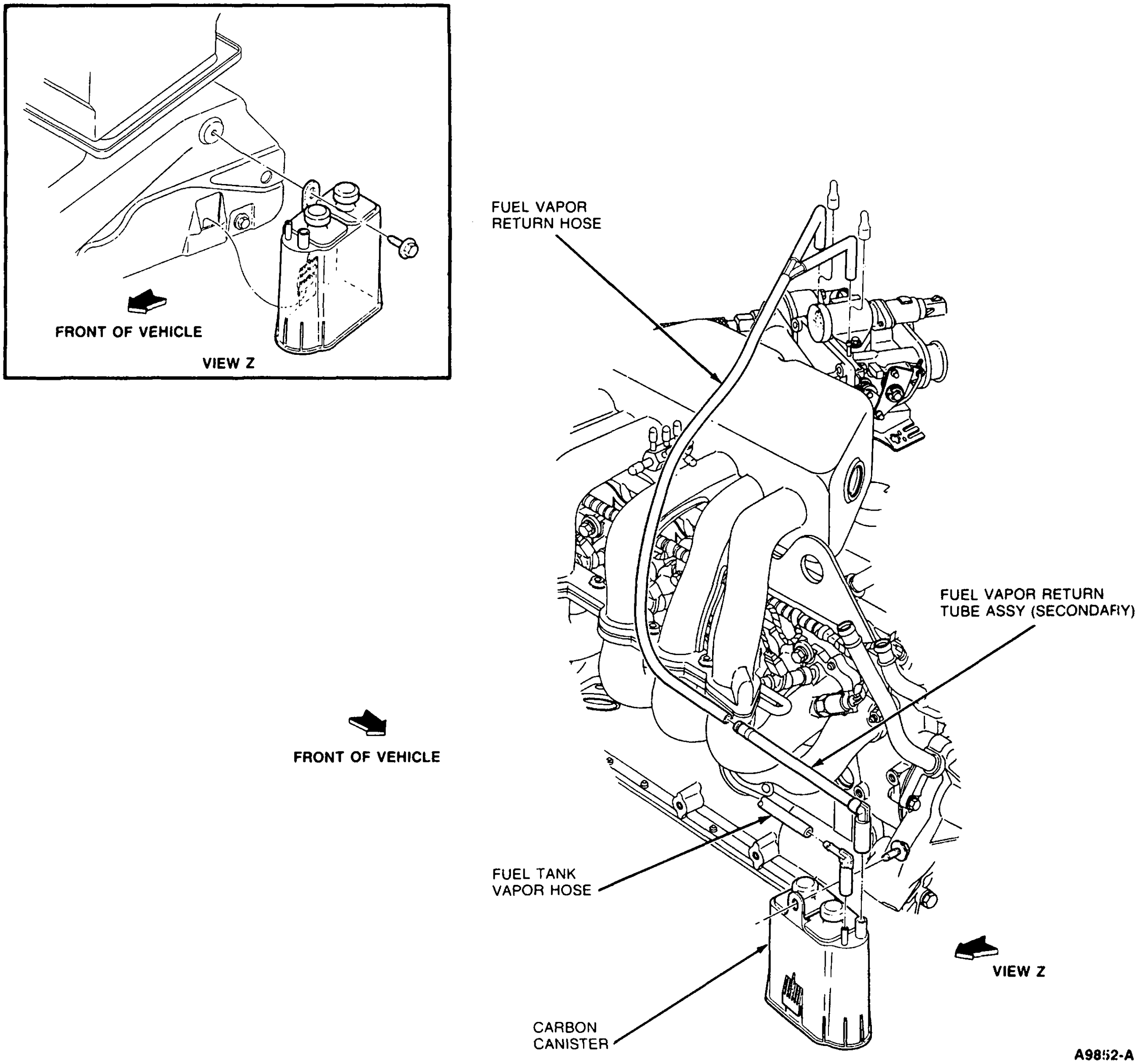


Figure 24 Typical 4.9L EFI F-Series and Bronco—Evaporative Emission System

Evaporative Emission Systems

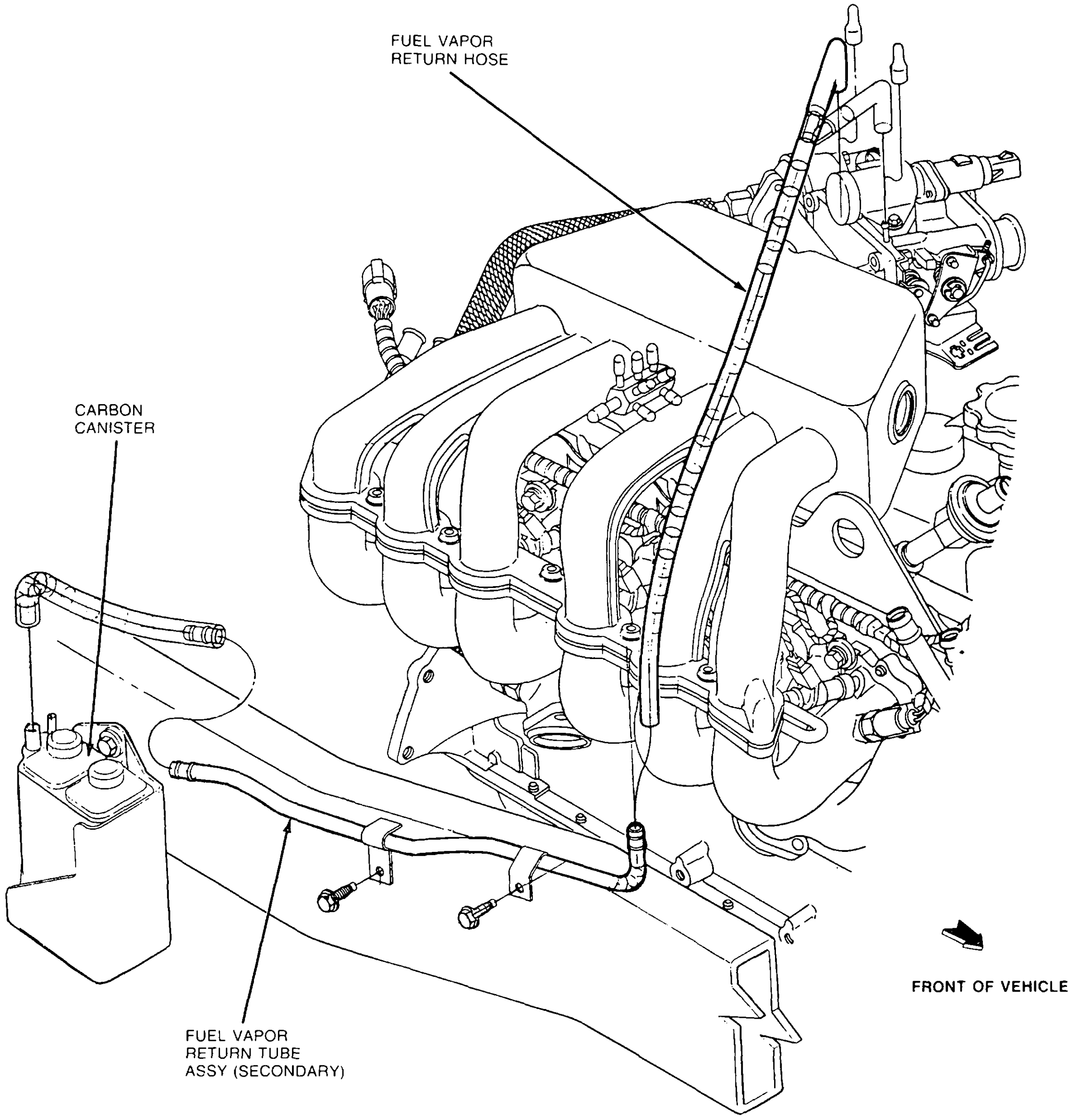


Figure 25 Typical 4.9L EFI E-Series—Evaporative Emission System

Evaporative Emission Systems

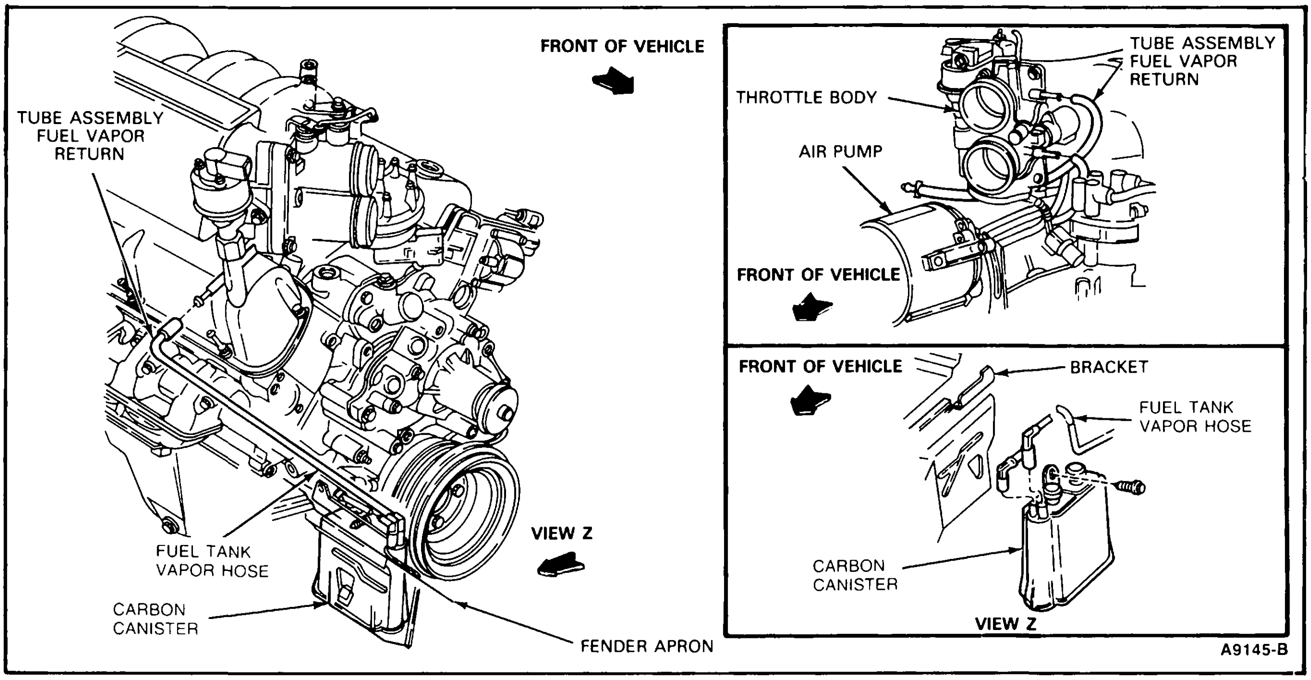


Figure 26 Typical 5.0L EFI, F-Series, Bronco, 50 States and Canada (Carbureted Only)—Evaporative Emission System

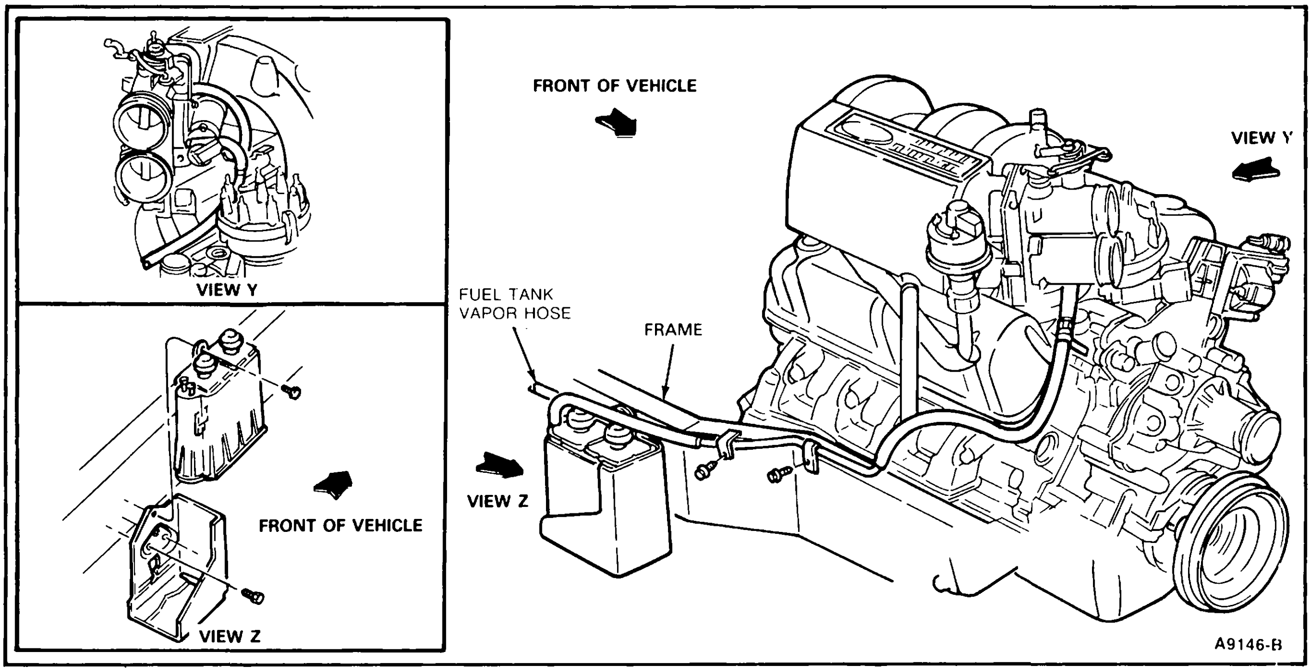


Figure 27 Typical 5.0L EFI, E-Series, 50 States and Canada (Carbureted Only)—Evaporative Emission System

Evaporative Emission Systems

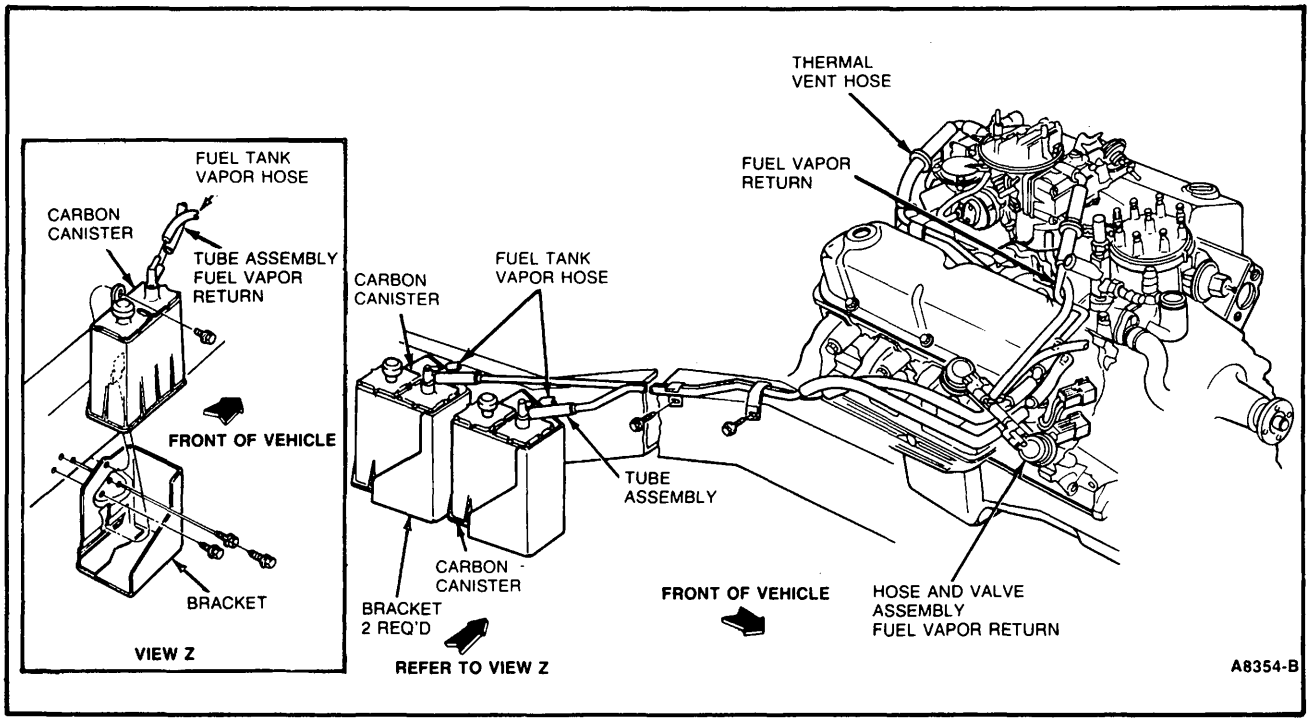


Figure 28 Typical 5.8L-4V 49S and Altitude—Econoline Light Truck (Carbureted Only)—Evaporative Emission System

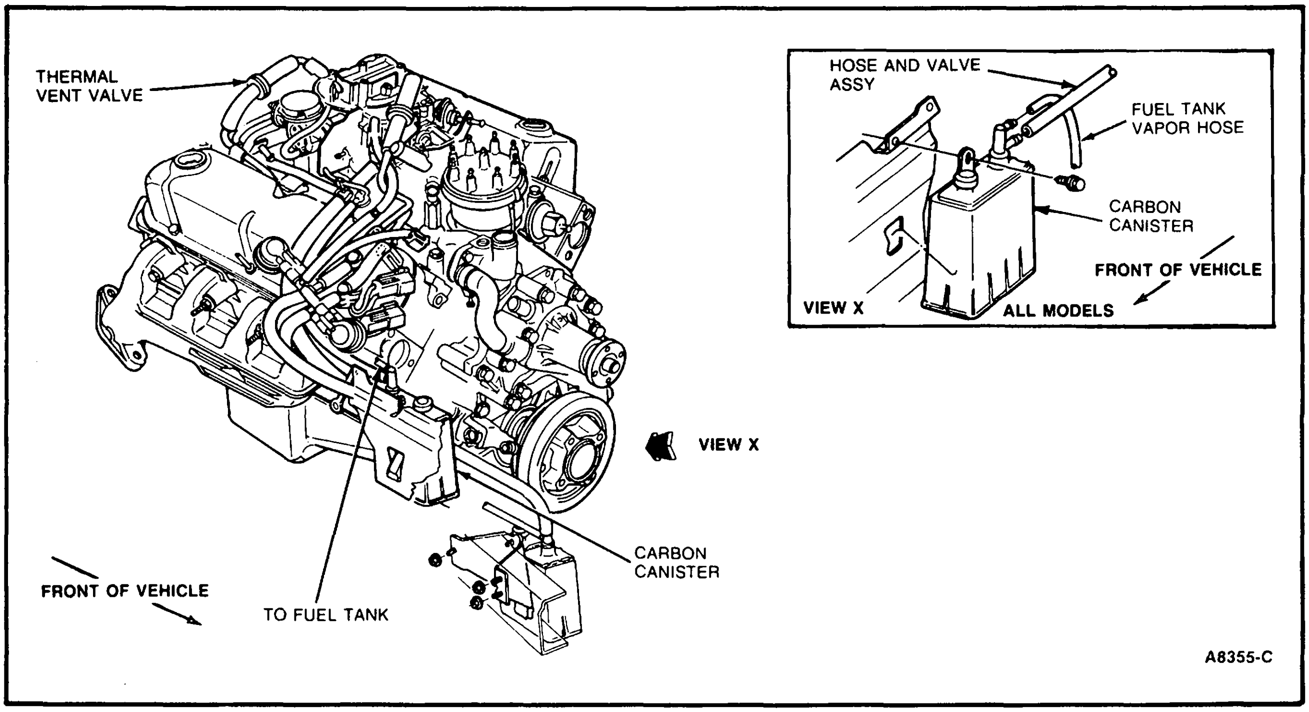


Figure 29 Typical 5.8L-4V 49S and Altitude—F-150, F-250, Bronco Light Truck (Carbureted Only)—Evaporative Emission System

Evaporative Emission Systems

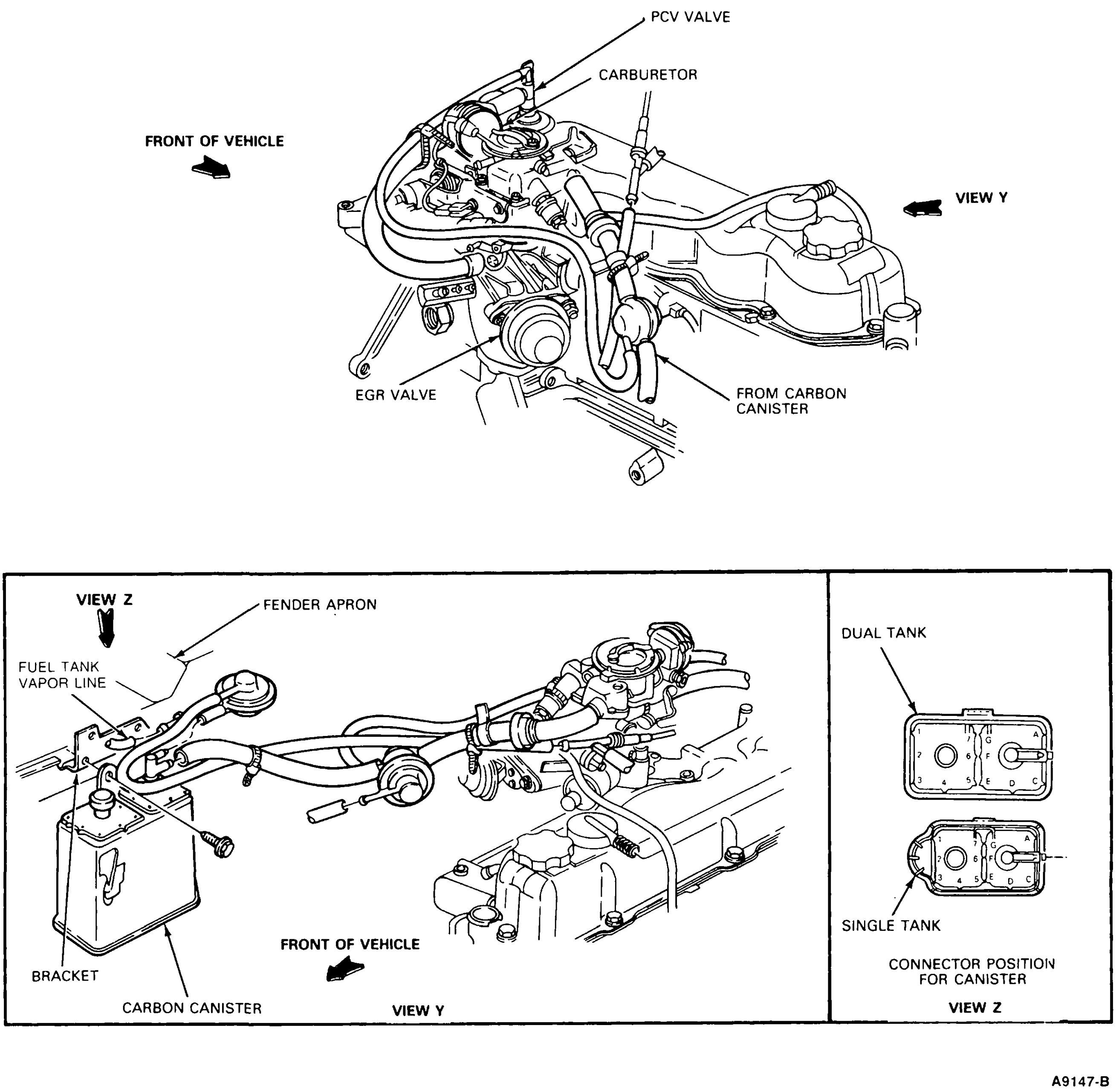


Figure 30 Typical 4.9L 49 States E and F-Series, Heavy Duty Truck (Carbureted Only)—Evaporative Emission System

Evaporative Emission Systems

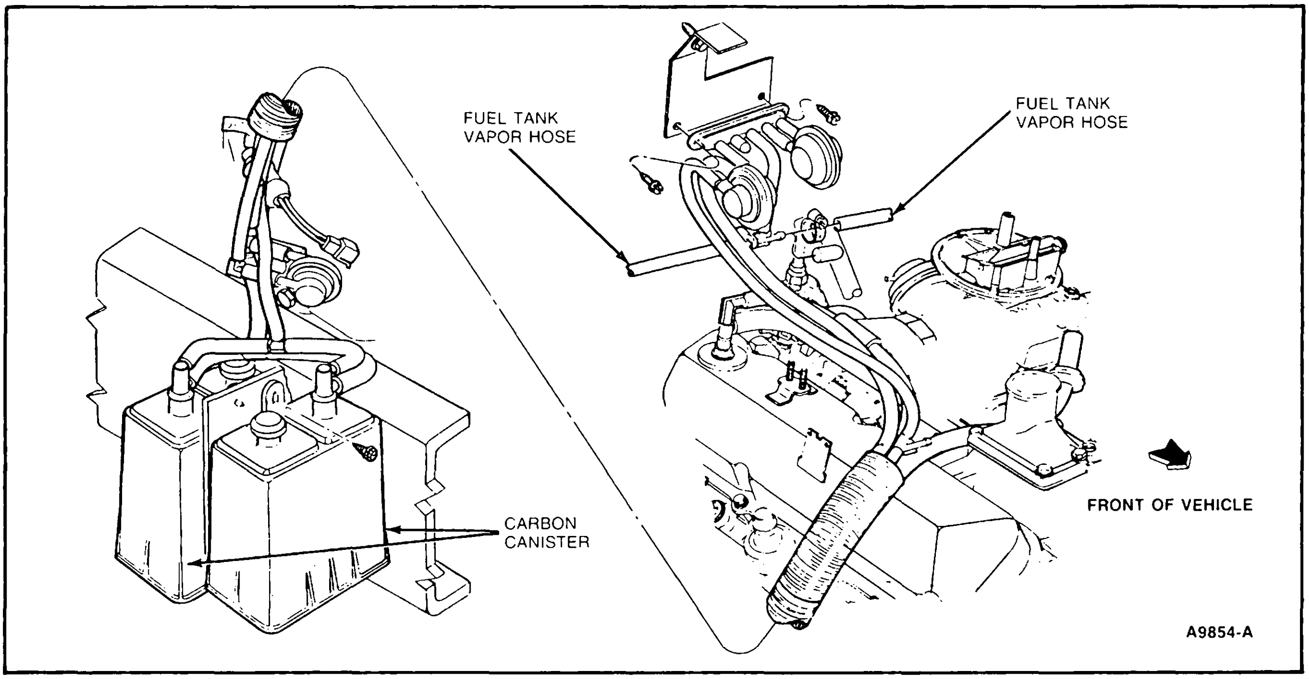


Figure 31 Typical 6.1L-2V 50 States, F and B Series, Heavy Duty Truck (Carbureted Only)—Evaporative Emission System

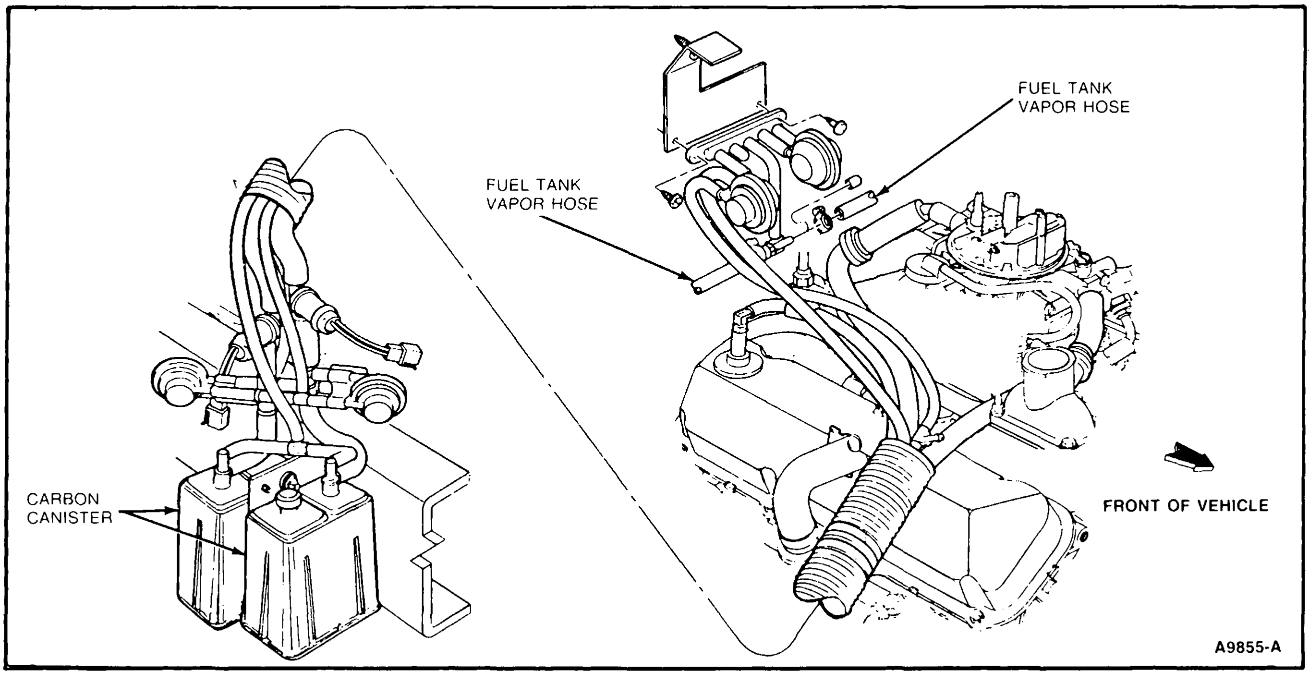


Figure 32 Typical 6.1L/7.0L-4V 50 States, F and B Series, Heavy Duty Truck (Carbureted Only)—Evaporative Emission System

Evaporative Emission Systems

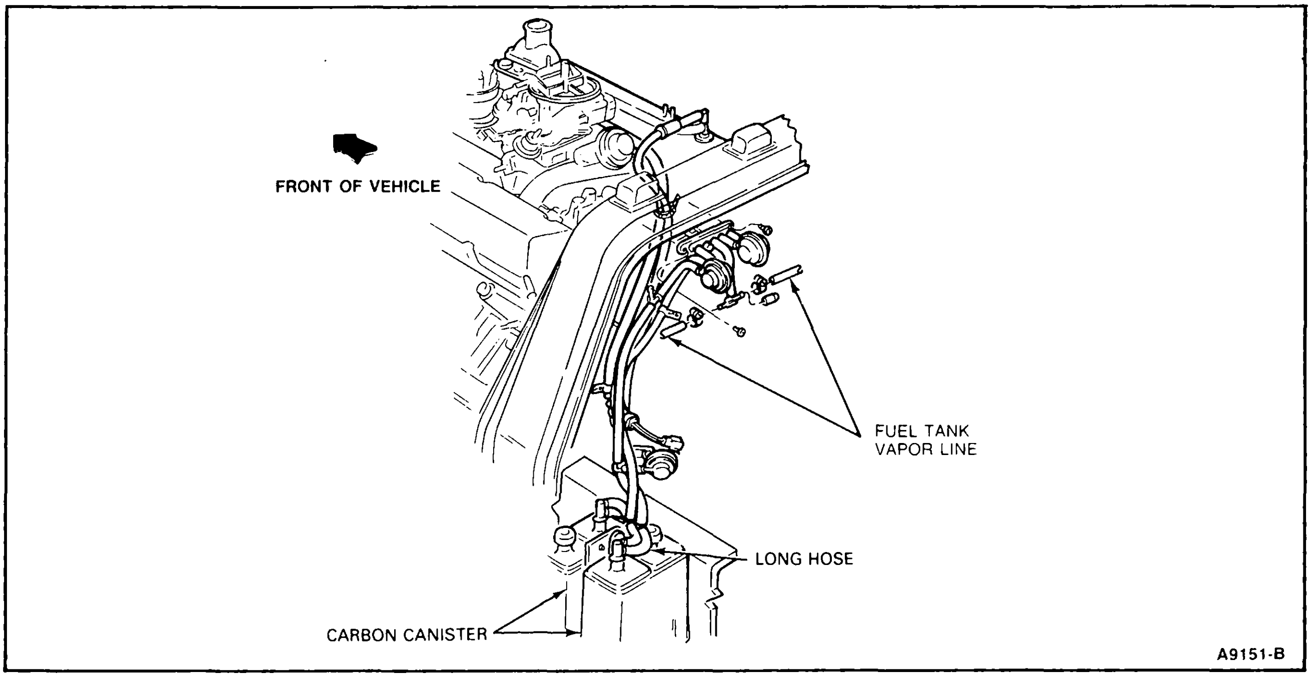


Figure 33 Typical 6.1L-2V 50 States, C-Series, Heavy Duty Truck (Carbureted Only)—Evaporative Emission System

Venting System

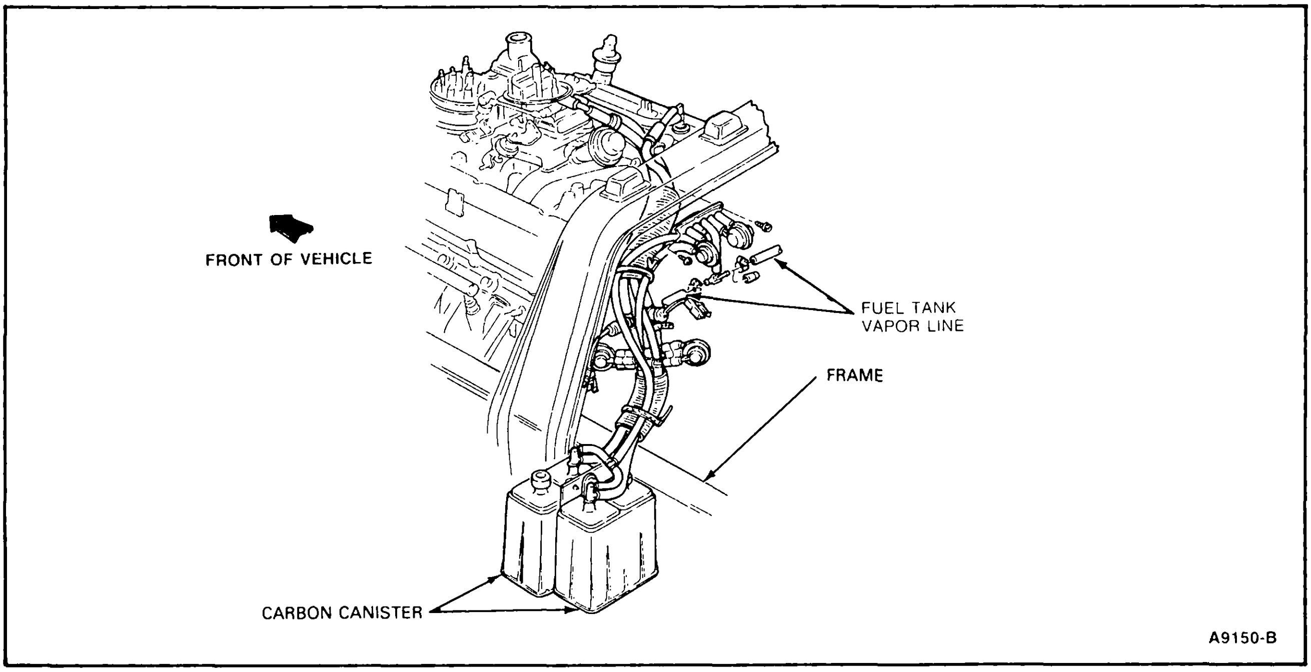


Figure 34 Typical 6.1L/7.0L-4V 50 States, C-Series, Heavy Duty Truck (Carbureted Only)—Evaporative Emission System

Evaporative Emission Systems

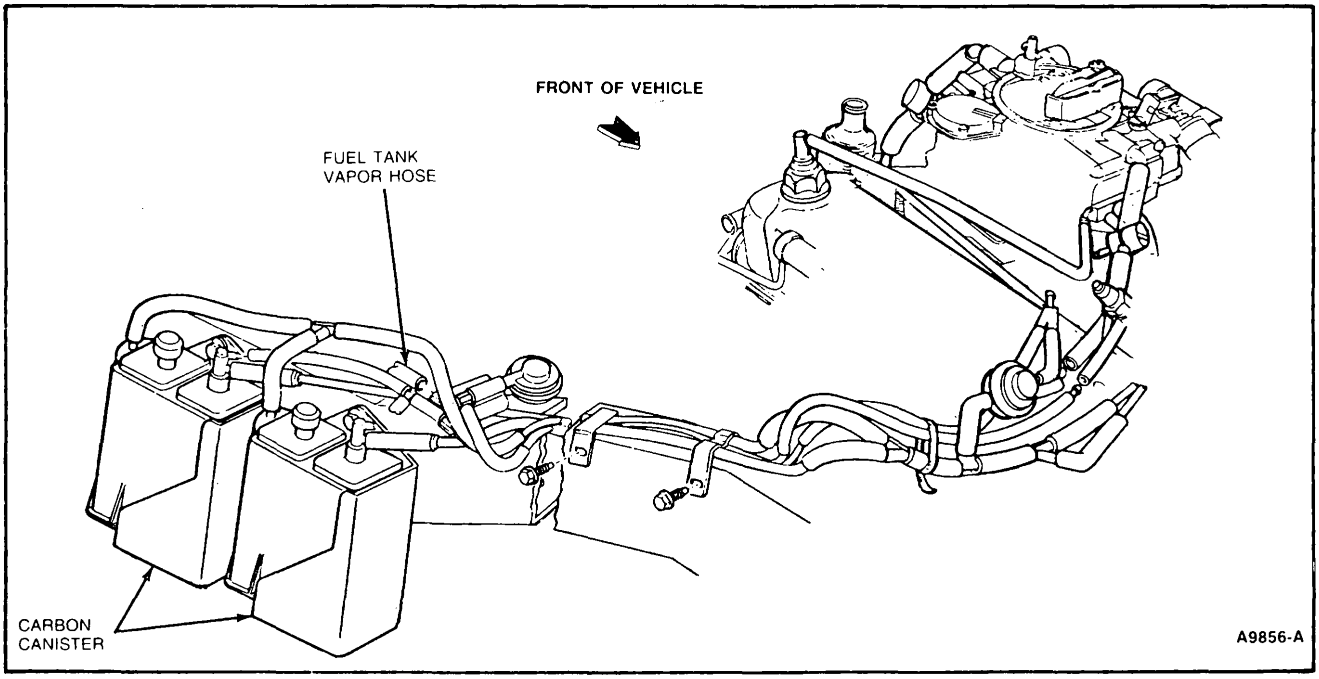


Figure 35 Typical 5.8L 49 States and Canada E and F-Series Heavy Duty Truck (Carbureted Only)— Evaporative Emission System

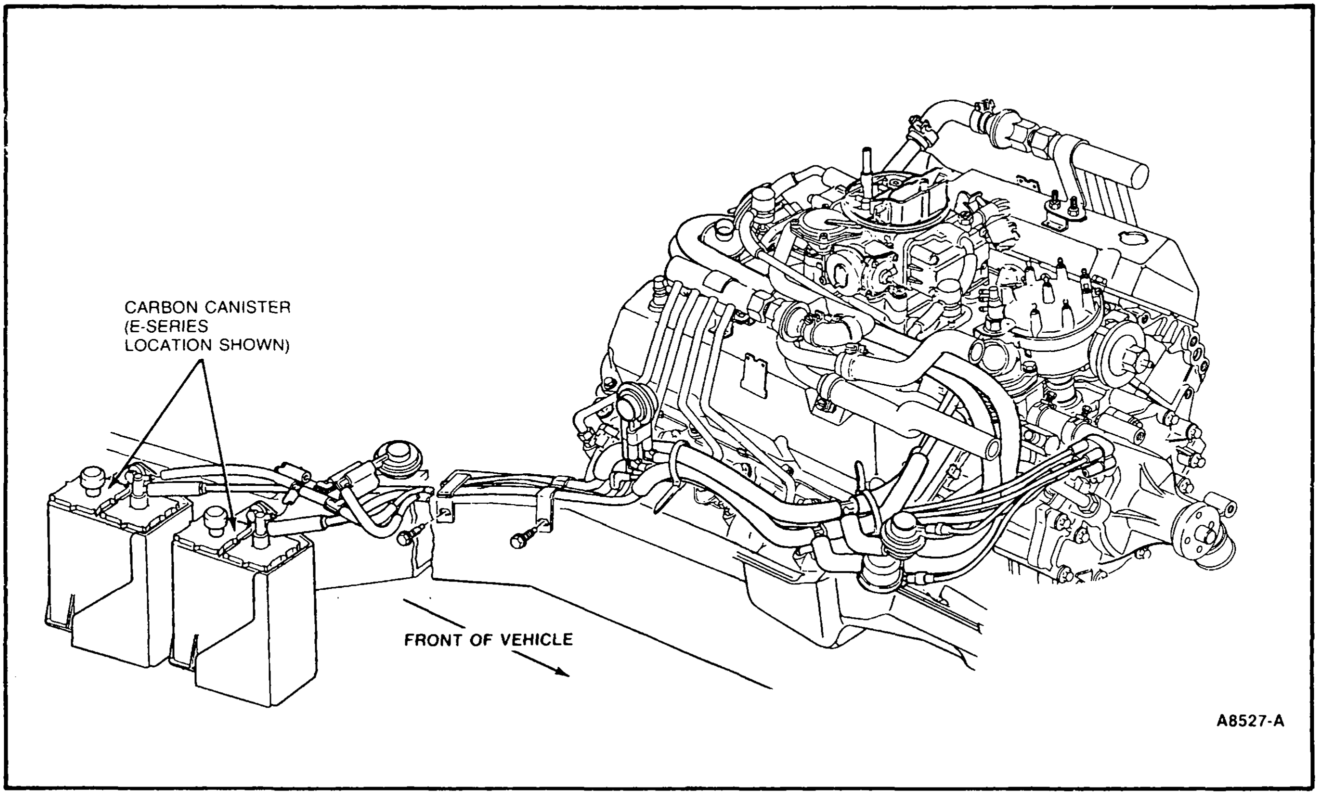


Figure 36 Typical 7.5L 49 States and Canada E-Series Heavy Duty Truck (Carbureted Only)— Evaporative Emission System

Evaporative Emission Systems

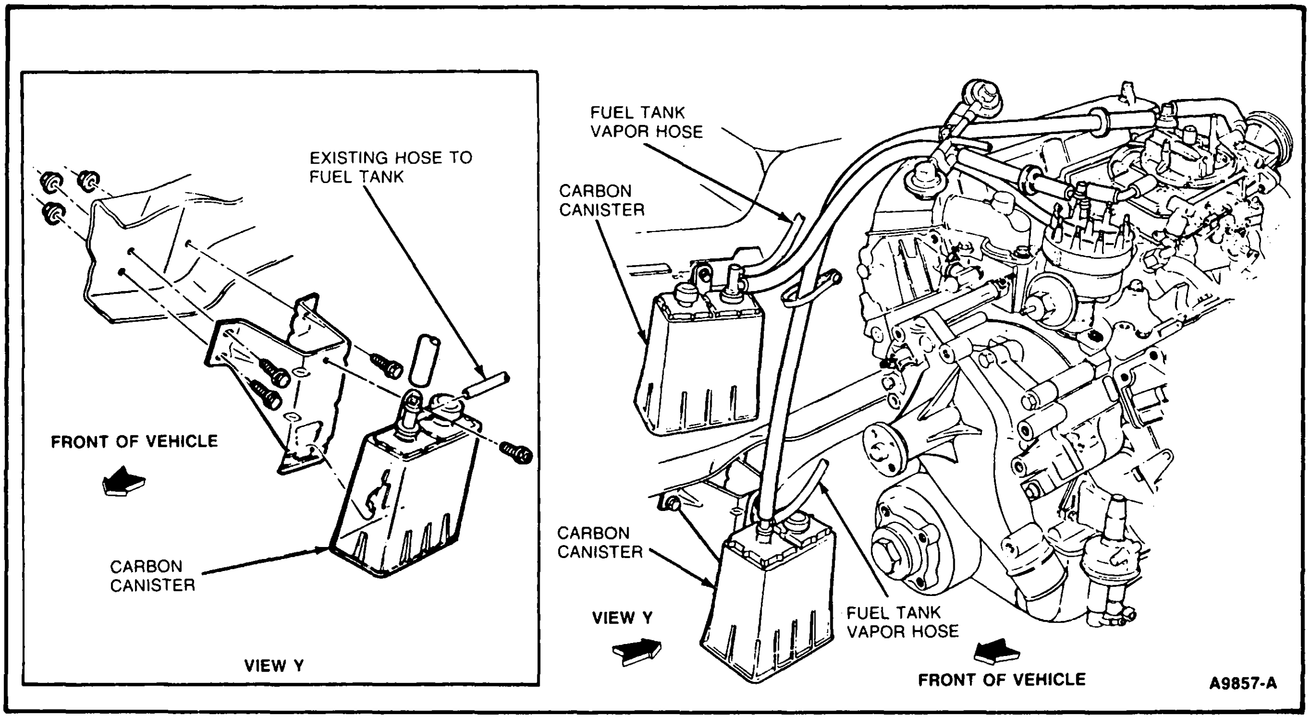


Figure 37 Typical 7.5L California and Canada—F-250, F-350, Heavy Duty Truck (Carbureted Only)— Evaporative Emission System

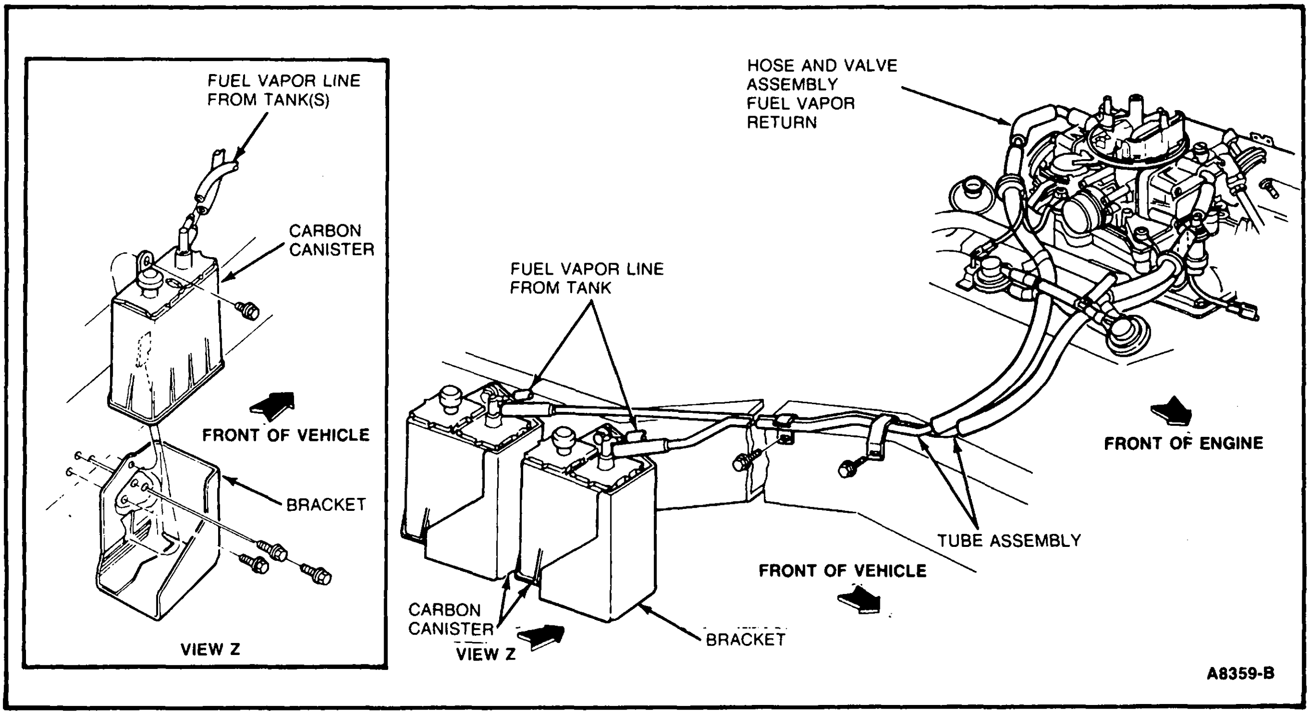


Figure 38 Typical 7.5L California and Canada—E-250, E-350, Heavy Duty Truck (Carbureted Only)— Evaporative Emission System

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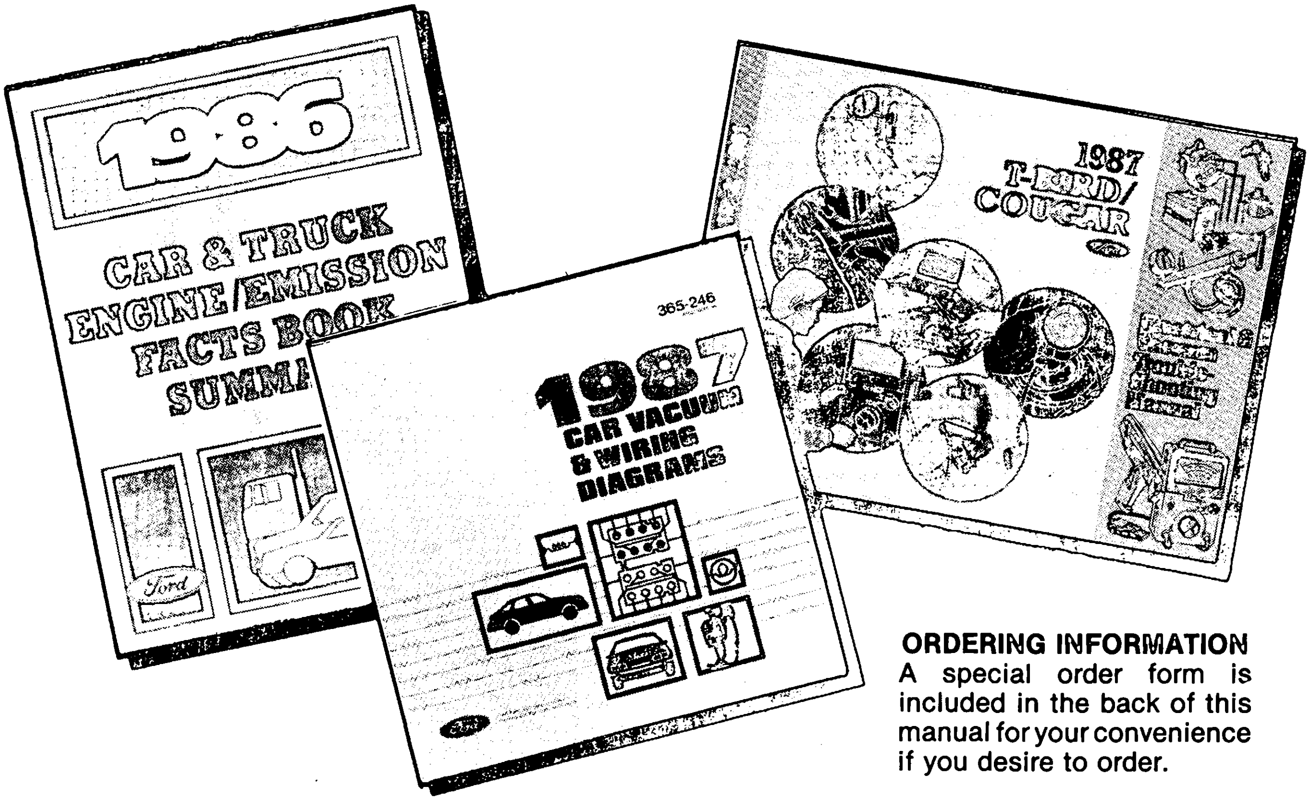
1986
CAR & TRUCK ENGINE/EMISSION FACTS BOOK SUMMA
Ford
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1987 CAR VACUUM & WIRING DIAGRAMS
1987 T-BIRD/COUGAR

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ENGINE EMISSIONS FACTS BOOK

- The manual contains complete specifications for each calibration number.
- Published at the conclusion of the model year.

ELECTRICAL & VACUUM TROUBLESHOOTING MANUAL (EVTM)

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Service Specifications Manuals

(CAR AND TRUCK)

- These manuals contain all specifications including maintenance and lubrication contained in the Shop Manuals in a handy pocket size for easy reference.
- Available in the first quarter of the model year.

SECTION 8

Inlet Air Temperature Systems

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Diagnostic Check Of All Vacuum Operated Duct Systems 8-1

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Inlet Air Temperature Systems

DESCRIPTION

All passenger vehicles and light truck engines are equipped with dry-type air cleaners incorporating a replaceable air filter element and all except 2.3L, 2.5L, 2.9L, 3.0L, 3.8L, 5.0L passenger car have a replaceable crankcase ventilation system filter element in the air cleaner. The 2.5L CFI, 2.3L OHC, 2.9L EFI, 3.0L EFI, and 5.0L SEFI, do not have a crankcase ventilation system filter element. The 2.3L HSC, and 3.8L have a replaceable oil fill cap that contains the crankcase breather filter. The air cleaner assembly uses various sensors, switches, and vacuum motors to control intake air temperature. In addition, there are different sensors for other engine control systems, mounted either in or on the air cleaner assembly.

The air cleaner assembly intake duct is attached to a cold air intake on most calibrations, as well as a heat shroud that surrounds the exhaust manifold. Air flow through these two sources is controlled by a door in the duct that is operated by a vacuum motor. Operation of the motor is controlled by delay valves, temperature sensors, and other vacuum control systems—all vary with each application and engine calibration.

Diagnostic Check

Vacuum Operated Duct Systems Except 4.9L EFI Light Truck

The primary purpose of the duct system is to provide maximum warm air available from the heat shroud to the intake system, and then after vehicle is warm, maintain a temperature in the 70°F to 105°F range by proportioning the warm and fresh air mixture. The functional check of this system should be performed on the vehicle in an ambient temperature of not less than 60°F (15.3°C):

1. Apply parking brake and block wheels.

2. Remove air cleaner cover and element. Inspect the heat riser tube for proper installation and/or damage. Service as required.

3. Remove components as necessary to ensure that the duct door is in the open to fresh air position. If door is in the closed to fresh air position, check for binding and sticking. Service or replace as required.

4. Check vacuum source and integrity of vacuum hoses to bimetal sensor, CWM and vacuum motor.

5. Start the engine. If the duct door has moved to the "heat on" position (closed to fresh air) go to Step 7. If door stays in "heat off" position (closed to warm air), place a finger over bleed of bimetal sensor. Duct door must move rapidly to the "heat on" position. If the door does not fully move to "heat on" position, stop engine and replace vacuum motor. Repeat this Step with new vacuum motor.

6. With engine off, cool bimetal sensor and cold weather modulator (CWM) by spraying with liquid from a small can of refrigerant R-12 with an adapter ZRE-6271 or equivalent, for 20 seconds after liquid contacts sensor and CWM.

CAUTION: Do not cool bimetal sensor while the engine is running. If refrigerant R-12 is drawn into the intake system while the engine is running, poisonous phosgene gas will be exhausted into the test area. Perform this test only in a well-ventilated area.

Inlet Air Temperature Systems

Restart engine. Duct door should move to the "heat on" position. If door does not move or moves only partially, replace sensor. Cool CWM and bimetal sensor.

7. Start and run engine briefly (less than 15 seconds). Duct door should move to "heat on" position.

8. Shut off engine and observe duct door:

   A. Vehicles without CWM: Valve will return slowly to "heat off" position (10 to 30 seconds).

   B. Vehicles with CWM: Valve will stay in "heat on" position for at least 2 minutes. If less than 2 minutes replace CWM and repeat this Step after cooling CWM and bimetal sensor.

The following are schematic representations of some 1987 Passenger Car and Truck inlet air systems:

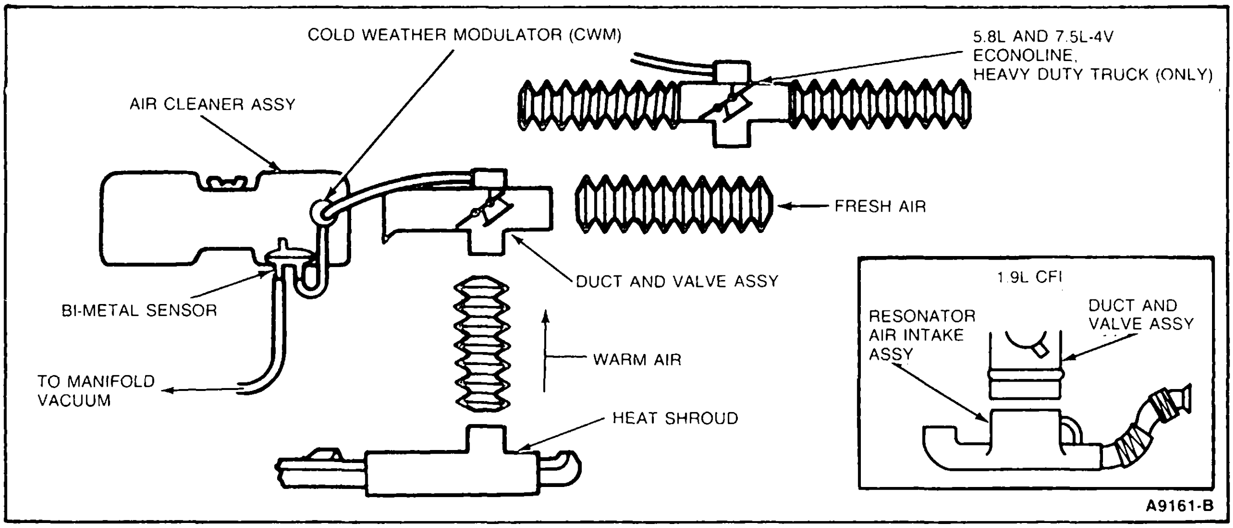

Figure 1 Typical Air Cleaner and Duct System, Carburetor and Throttle Body Applications—1.9L, 3.8L CFI, 5.8L (Passenger Car); 2.0L, 5.0L, 5.8L, 6.1L, 7.0L, 7.5L-4V (Light and Heavy Duty Truck)

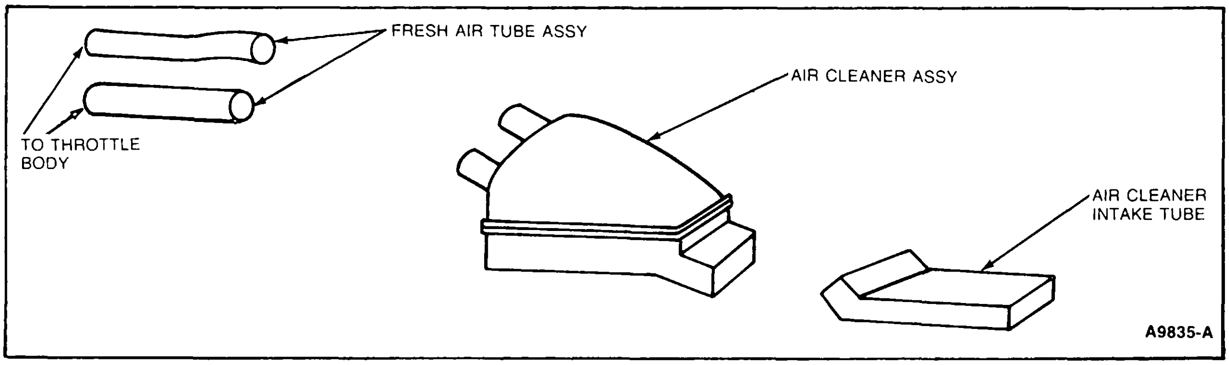

Figure 2 Typical Air Cleaner System—7.5L EFI (Light Truck) (1987½)

Inlet Air Temperature Systems

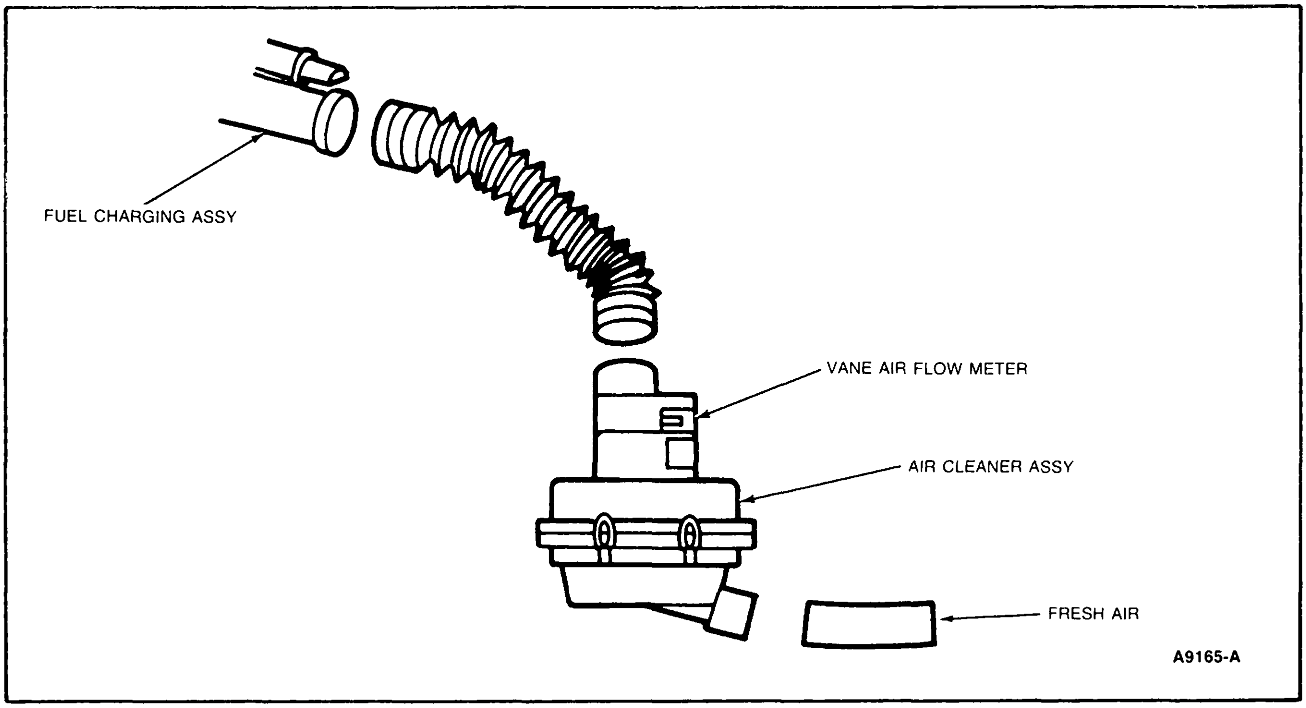

Figure 3 Typical Air Cleaner System—1.9L EFI (Passenger Car)

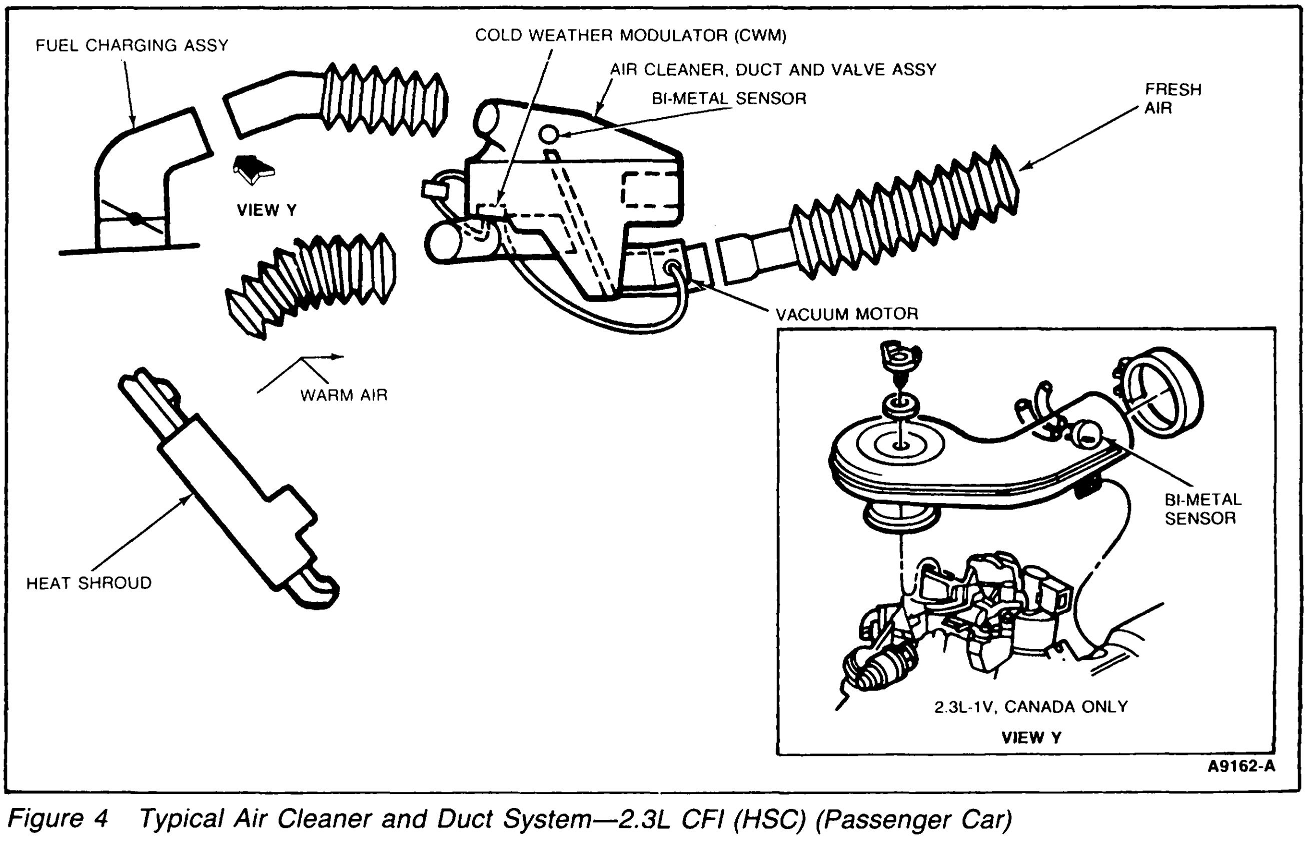

Figure 4 Typical Air Cleaner and Duct System—2.3L CFI (HSC) (Passenger Car)

Inlet Air Temperature Systems

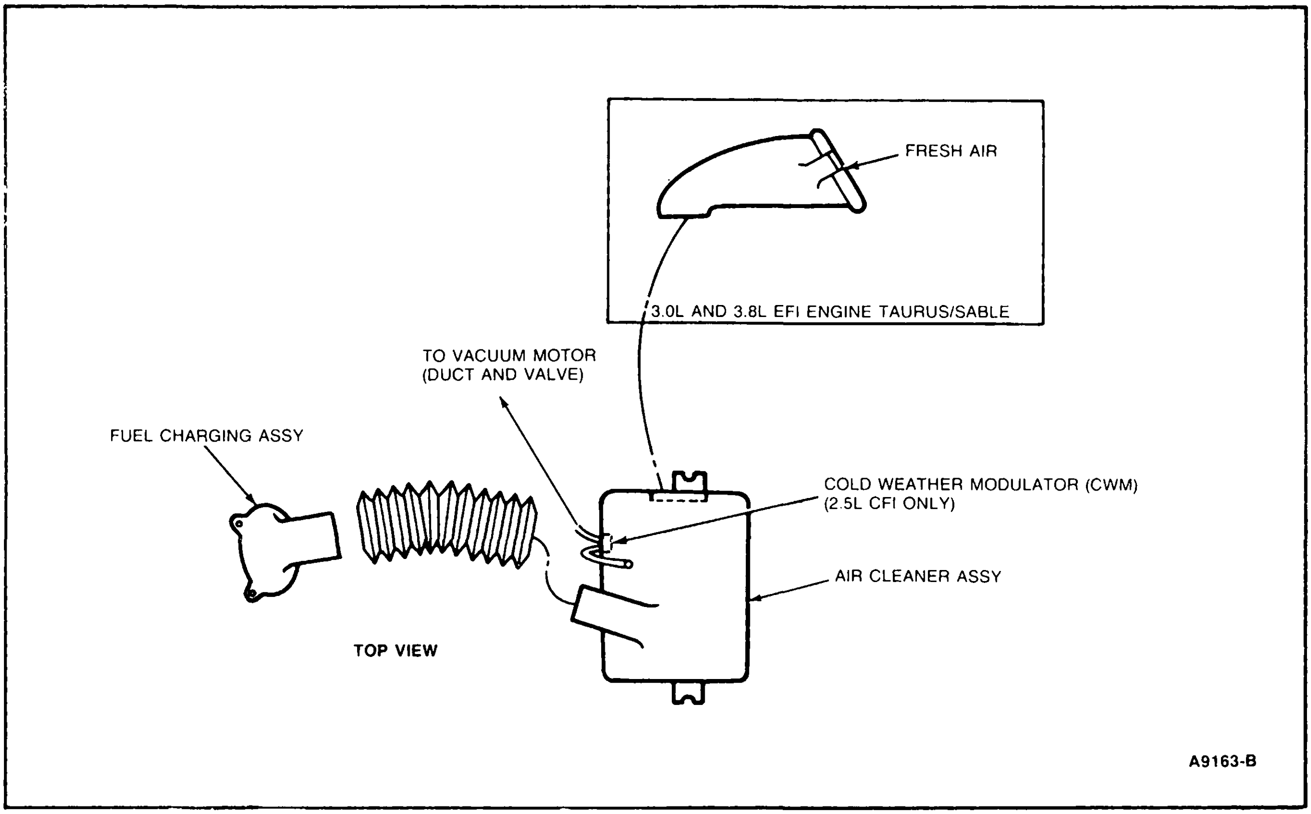

Figure 5 Typical Air Cleaner and Duct System—3.0L EFI and 3.8L EFI (Taurus/Sable)

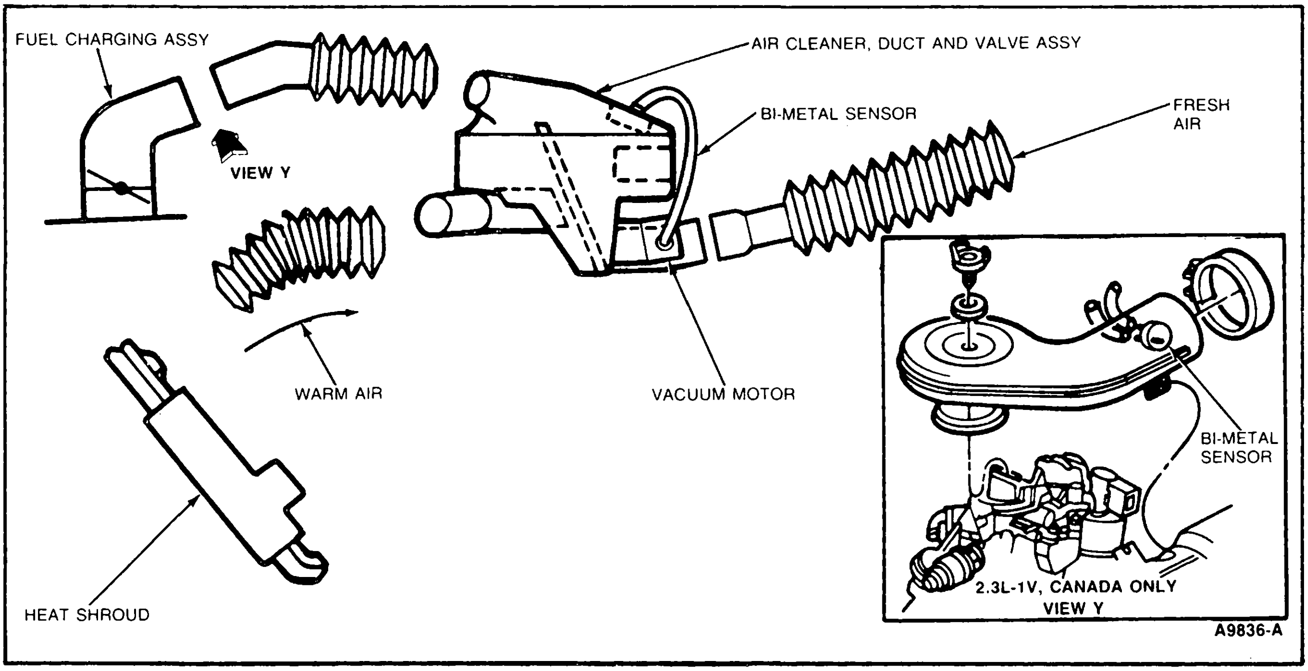

Figure 6 Typical Air Cleaner and Duct System—2.3L (OHC) (Passenger Car)

Inlet Air Temperature Systems

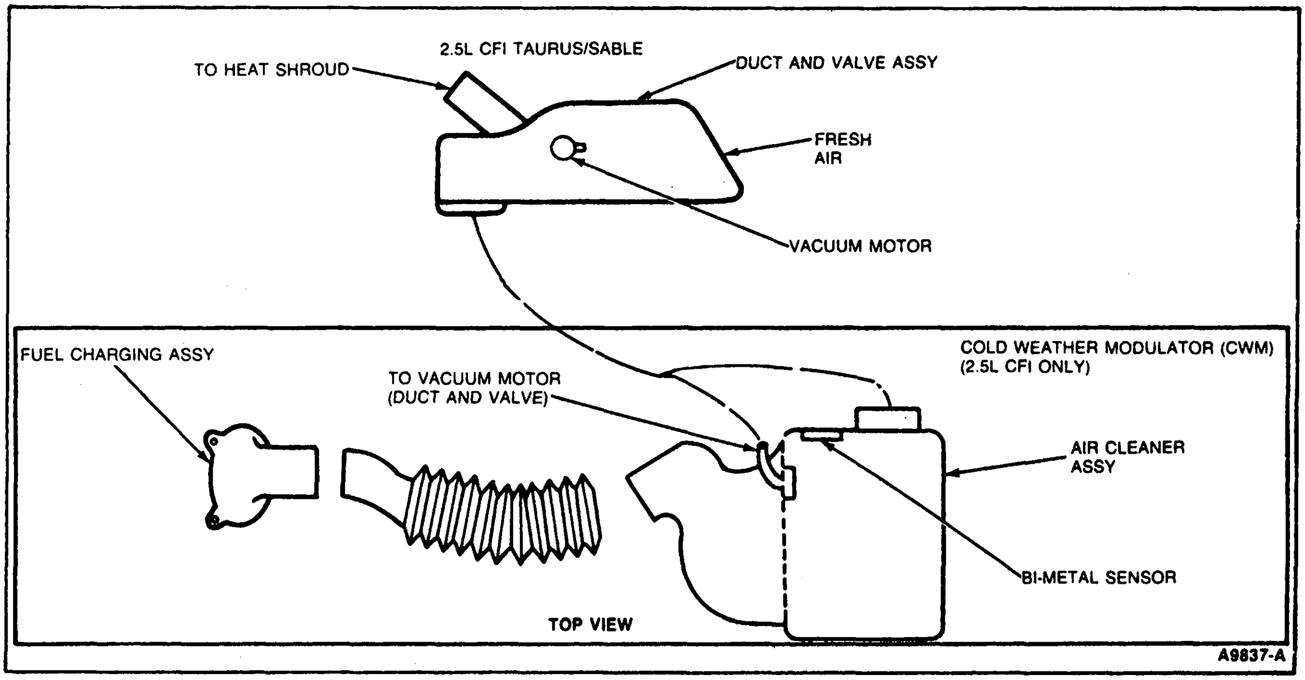

Figure 7 Typical Air Cleaner and Duct System—2.5L CFI (HSC) (Passenger Car)

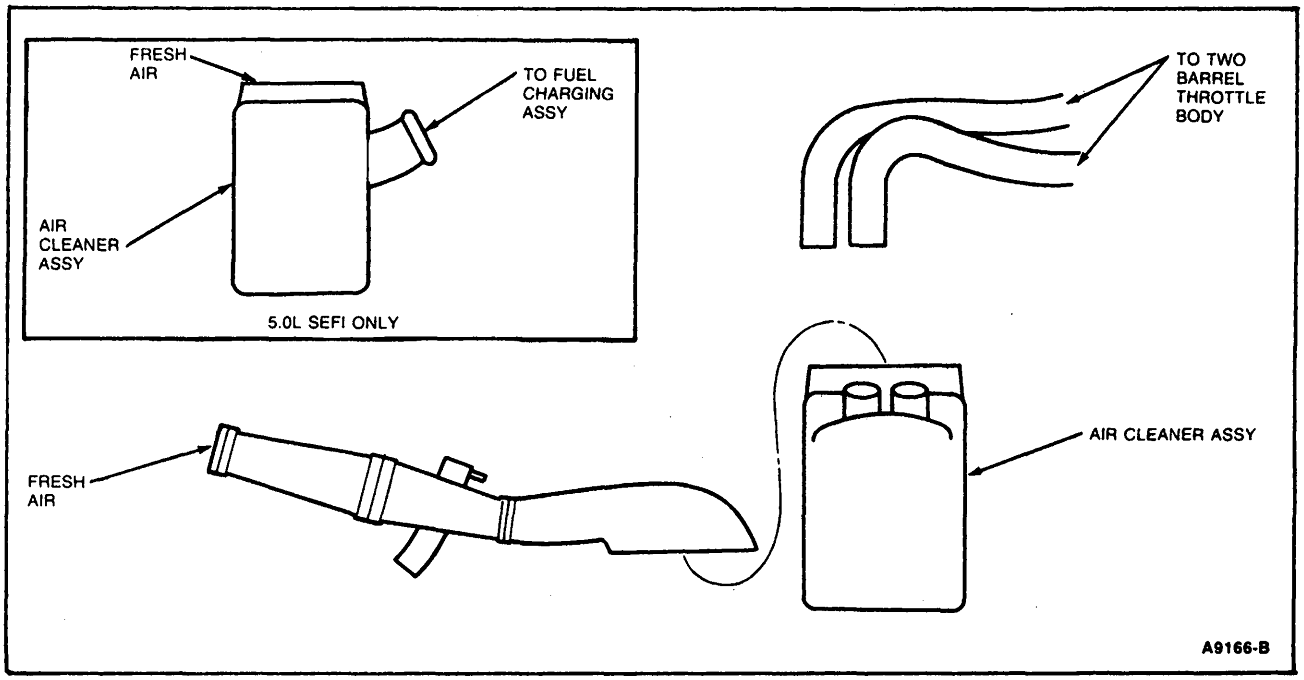

Figure 8 Typical Air Cleaner and Duct System—5.0L SEFI (Passenger Car); 5.0L EFI (Light Truck)

Inlet Air Temperature Systems

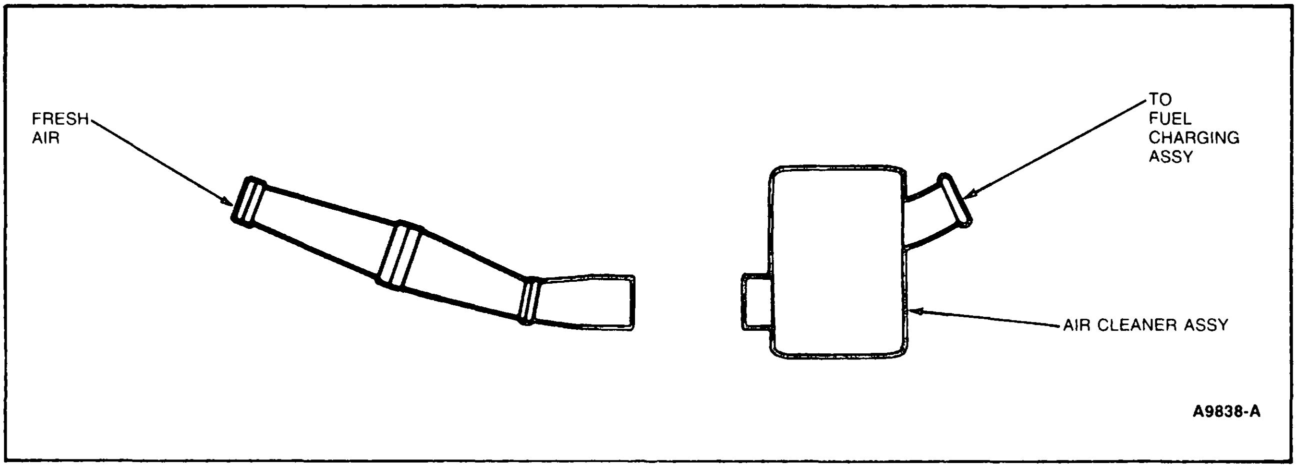

Figure 9 Typical Air Cleaner and Duct System—3.8L EFI (Thunderbird/Cougar)

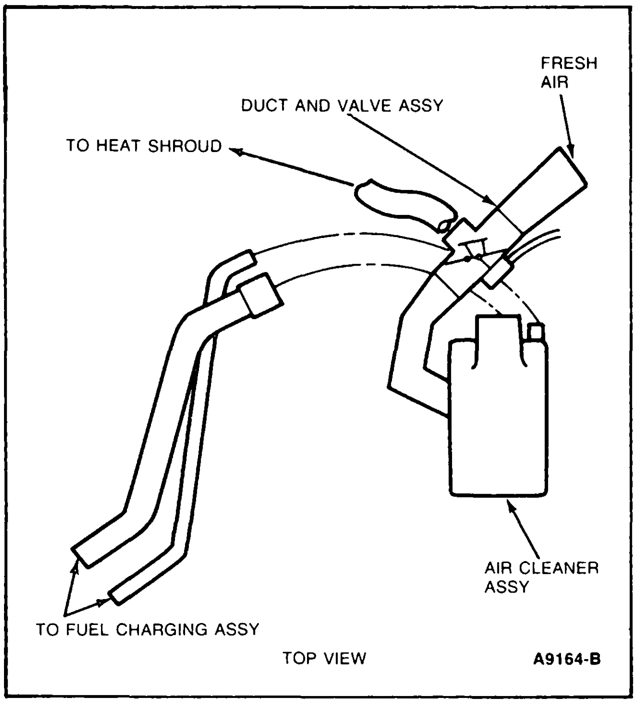

Figure 10 Typical Air Cleaner and Duct System—2.3L EFI, 2.9L EFI (Light Truck)

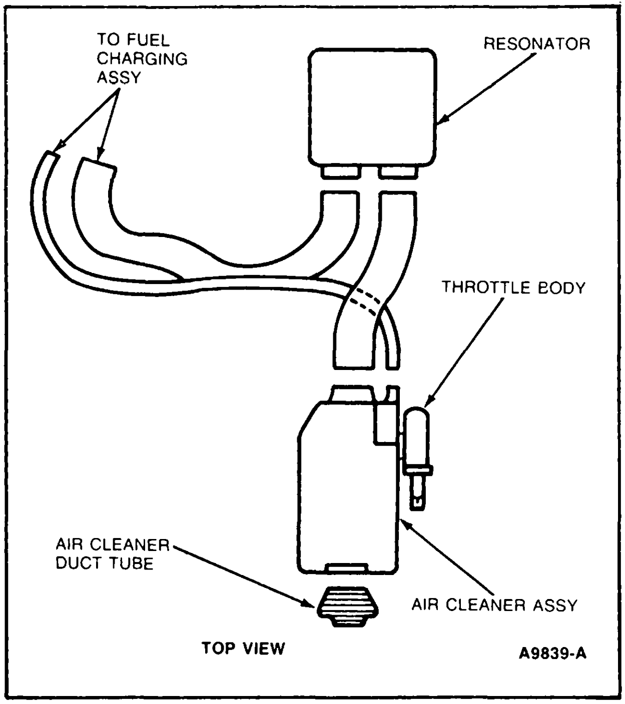

Figure 11 Typical Air Cleaner System—2.3L EFI (OHC) (Aerostar)

Inlet Air Temperature Systems

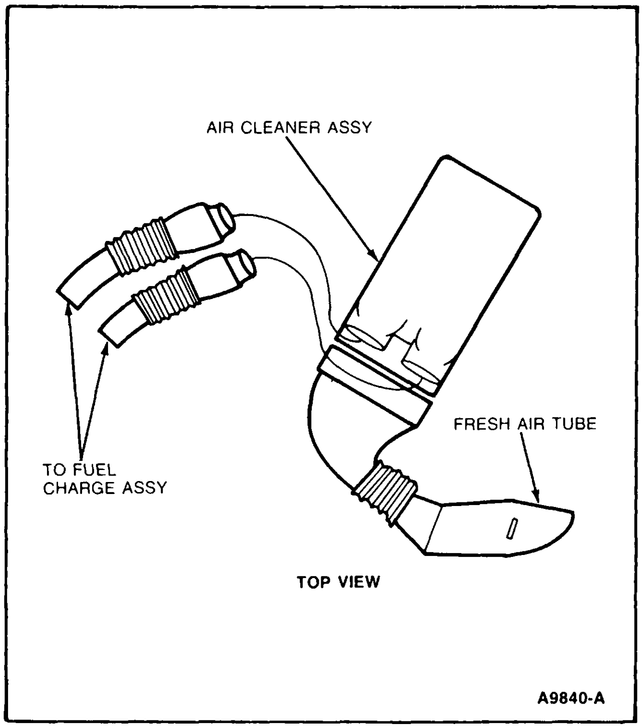

Figure 12 Typical Air Cleaner and Duct System— 4.9L EFI (F-Series and Bronco)

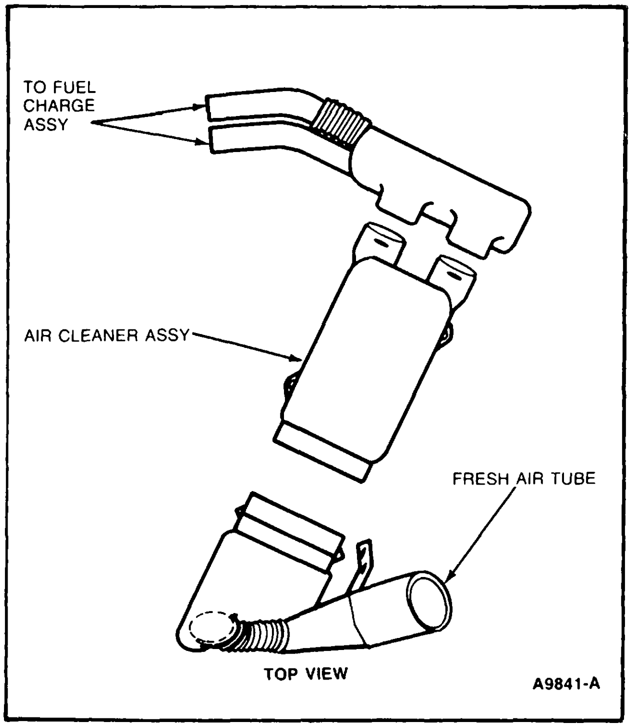

Figure 13 Typical Air Cleaner and Duct System— 4.9L EFI (E-Series)

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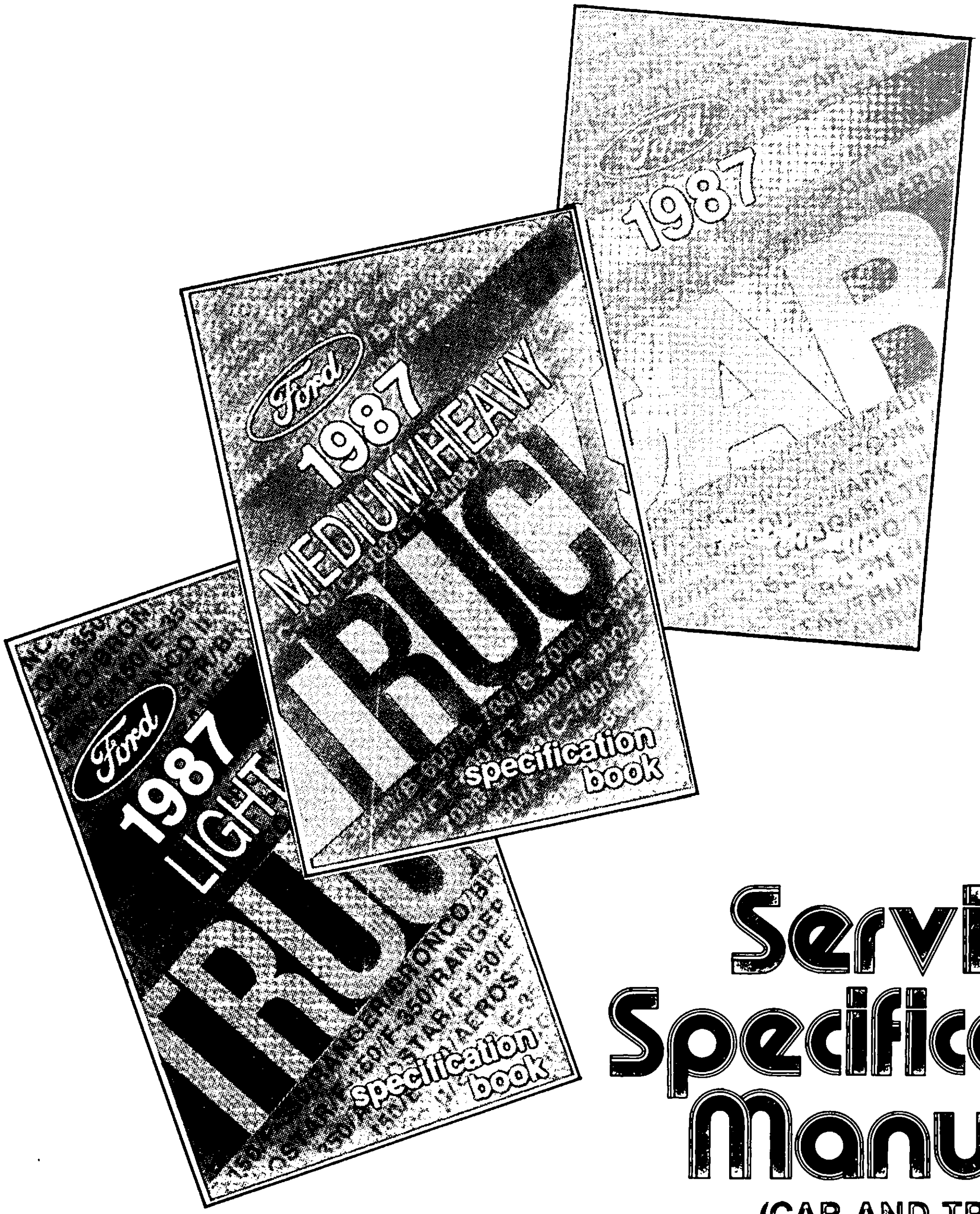

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SECTION 9

Positive Crankcase Ventilation Systems

Contents

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Diagnostics—Typical PCV System 9-2

Diagnostics—Unique 1.9L CFI PCV System 9-4

Positive Crankcase Ventilation System

DESCRIPTION

Typical Positive Crankcase Ventilation (PCV) System

The positive crankcase ventilation system (Figure 1) cycles crankcase gases back through the engine where they are burned. In a typical system, the PCV valve regulates the amount of ventilating air and blow-by gas to the intake manifold and prevents backfire from traveling into the crankcase. The PCV valve should be mounted in a vertical position (Figure 1). On some engine applications, the PCV system is connected with the evaporative emission system.

Unique 1.9L CFI Positive Crankcase Ventilation (PCV) System

The vent system for the 1.9L engine (Figure 2) does not depend on a flow of scavenging air, as do all other Ford engines, but evacuates crankcase vapors that are drawn into the intake manifold in metered amounts through a Dual Orifice Valve Assembly. A small orifice is connected to the intake manifold at all times. A larger orifice, controlled by a throttle body port signal, opens to the intake manifold during part throttle and WOT operation. If the availability of crankcase vapor is low (at idle for instance) air may be drawn along with crankcase vapor through the smaller orifice. If the availability of crankcase vapor is high (at high speed operation) crankcase vapor is delivered to the intake manifold through both orifices. If the amount of crankcase vapor available exceeds that which can be handled by the two orifices, the excess flow is routed to the air cleaner. The Dual Orifice Valve is the critical point of this system.

Positive Crankcase Ventilation System

Diagnostic Test

PCV

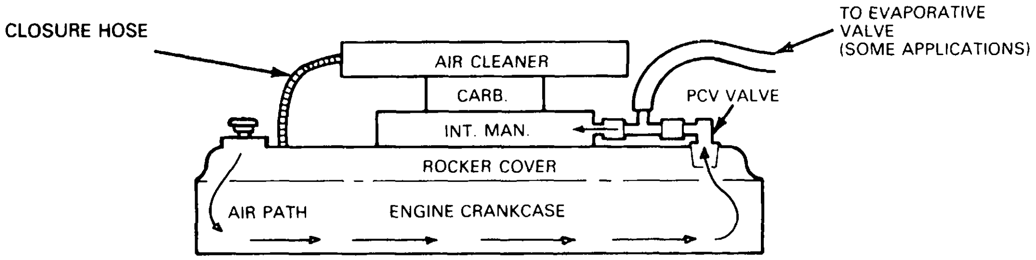

Figure 1 Typical PCV System (Except 1.9L with CFI)

Set parking brake and block wheels. Place transmission/transaxle in Neutral or Park. Place the A/C-Heat selector to the OFF position. Go to PCV Test Step 1.

TEST STEP	RESULT ▶	ACTION TO TAKE
PCV1 STUCK PCV VALVE CHECK		
• Remove PCV valve from rocker cover grommet. • Shake the PCV valve. • Does the PCV valve rattle when shaken?	Yes ▶	GO to PCV 2.
	No ▶	PCV valve is sticking. REPLACE PCV valve.
PCV2 PCV SYSTEM CHECK		
• Start engine and bring to normal operating temperature. • Disconnect hose from air cleaner. • Place a stiff piece of paper over the hose, wait one minute. • Does the vacuum hold the paper in place? • For 2.3L HSC, 2.9L & 4.9L remove the corrugated hose from the oil separator nipple and place a stiff piece of paper over the nipple, wait one minute. • Does the vacuum hold the paper in place?	Yes ▶	System is OK. GO to Section 2 for vehicle symptoms.
	No ▶	System is plugged or Evaporative Emission Valve is leaking, GO to PCV3.
PCV3 EVAPORATIVE EMISSION SYSTEM CHECK		
• Disconnect evaporative hose, cap the TEE, and retest. • Place a stiff piece of paper over the hose, wait one minute. • Does the vacuum hold the paper in place?	Yes ▶	GO to Evaporative Emission System, Section 7.
	No ▶	CHECK for vacuum in the system (filler cap, PCV valve, hoses, oil separator on 2.3L) and rocker cover for bolt torque/gasket leak. SERVICE as necessary.

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Positive Crankcase Ventilation System

Diagnostic Test

PCV

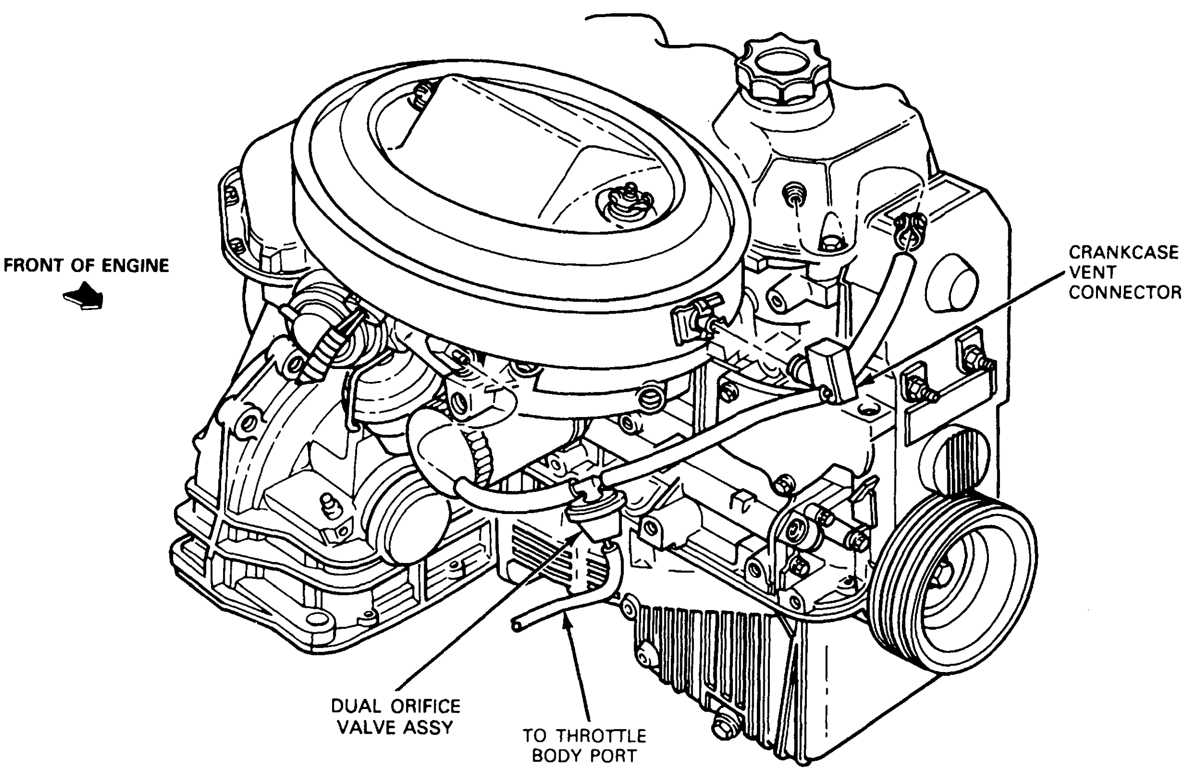

Figure 2 1.9L-CFI Engine PCV System

Set parking brake and block wheels. Place transmission/transaxle in Neutral or Park. Place the A/C-Heat selector to the OFF position. Bring engine to normal operating temperature and GO to PCV Test Step 1.

TEST STEP	RESULT ▶	ACTION TO TAKE
PCV1 1.9L-CFI HIGH SPEED PCV CHECK		
• Remove vacuum control hose at the dual orifice valve assembly (located at the throttle body port). • Apply manifold vacuum to port. • Is there significant change in engine rpm?	Yes ▶ No ▶	High speed PCV system is OK. GO to PCV 2. REPLACE the dual orifice valve assembly.

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Positive Crankcase Ventilation System

Diagnostic Test (Cont'd.)

PCV

TEST STEP	RESULT ▶	ACTION TO TAKE
PCV2 1.9L-CFI LOW SPEED CHECK		
• Remove crankcase vent connector from side of air cleaner. • Place a stiff piece of paper over the crankcase vent connector nipple, wait for one minute. • Does vacuum hold the paper in place?	Yes ▶ No ▶	Low speed PCV system is OK. GO to Section 2 for vehicle symptoms. GO to PCV3.
PCV3 CRANKCASE VENT CONNECTOR CHECK		
• Remove vacuum hose (small port) at the crankcase vent connector. • Place a stiff piece of paper over the vacuum hose. • Does the vacuum hold the paper in place?	Yes ▶ No ▶	REPLACE crankcase vent connector. GO to PCV4.
PCV4 DUAL ORIFICE VALVE ASSEMBLY CHECK		
• Remove dual orifice valve assembly from the system. • Check for blockage through the valve. • Is the valve clear of blockage?	Yes ▶ No ▶	GO to Section 2 for vehicle symptoms. REPLACE dual orifice valve assembly.

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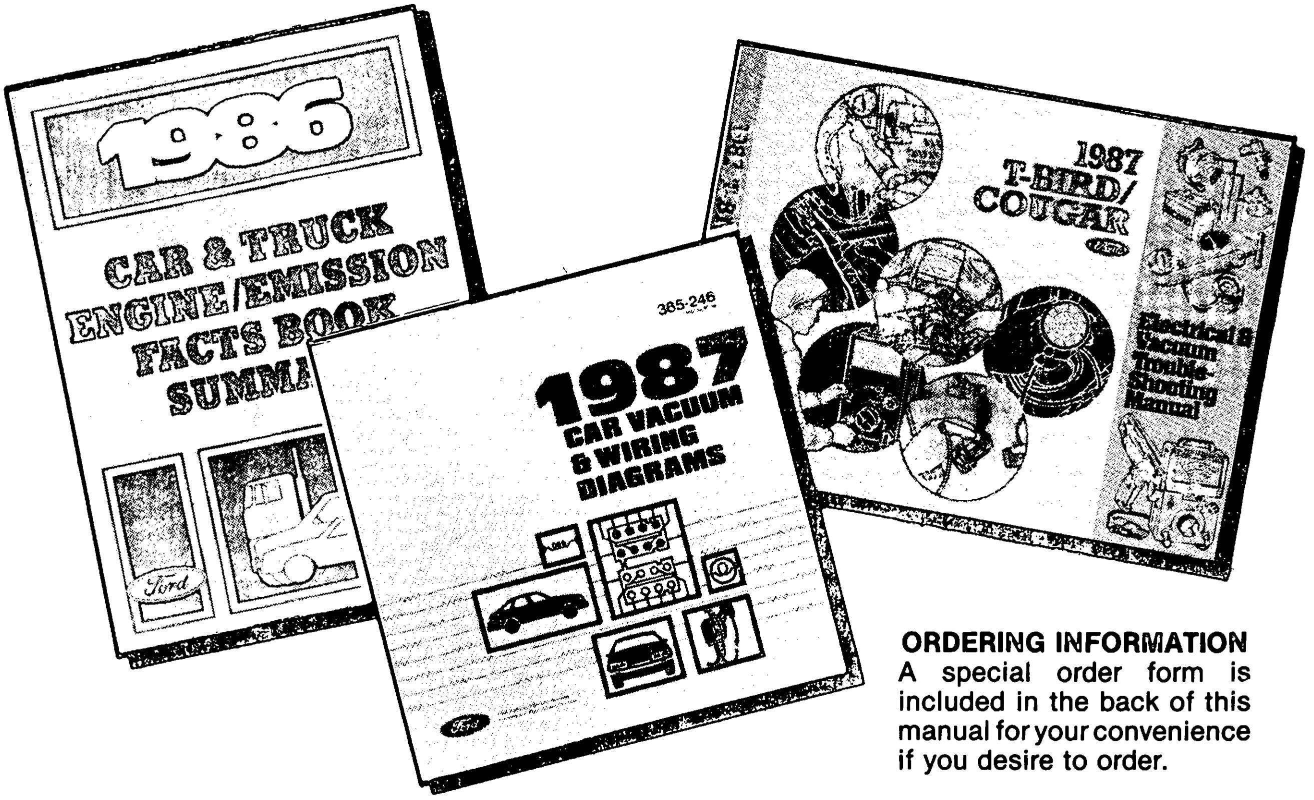

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SECTION 10

Thermactor Systems (Secondary Air Injection)

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Thermactor System Noise Test 10-9

Thermactor Air Pump Drive Belt Adjustment 10-10

Thermactor Systems (Secondary Air Injection)

Thermactor Air Injection System

Description

The Thermactor (air injection) Exhaust Emission Control System reduces the hydrocarbon and carbon monoxide content of exhaust gases by continuing the combustion of unburned gases after they leave the combustion chamber by injecting fresh air into the hot exhaust stream leaving the exhaust ports. At this point, the fresh air mixes with hot exhaust gases to promote further oxidation of both the hydrocarbons and carbon monoxide, thereby reducing their concentration and converting some of them into harmless carbon dioxide and water.

During some modes of operation (extended idle, etc.), the thermactor air is dumped to atmosphere, to prevent overheating in the exhaust system.

A typical Air Injection System consists of:

- Air Supply Pump and Centrifugal Filter
- Air Bypass Valve
- Check Valve
- Air Manifold
- Air Hoses
- Air Control Valve

Diagnosis

1. Inspect the belt drive system and the air distribution system to ensure that they are in place and operating. Refer to Noise Test and Belt Adjustment in this section.
2. Check out individual components, refer to Section 3.

Thermactor Systems (Secondary Air Injection)

Managed Air Thermactor System

The managed Thermactor Air System is utilized in several electronic and non-electronic control systems to divert thermactor air either upstream to the exhaust manifold check valve or downstream rear section check valve and dual bed catalyst. The system will also dump thermactor air to atmosphere during some operating modes.

Air control valve (9F491) is used to direct the air either upstream or downstream. An air bypass valve is used (9B289) to dump air to atmosphere (Figure 1). In some applications, the two valves are combined into a single air bypass/control valve (9F491) as shown in Figure 2.

Examples of other Managed Thermactor Air Systems are shown in Figures 3, 4 and 5.

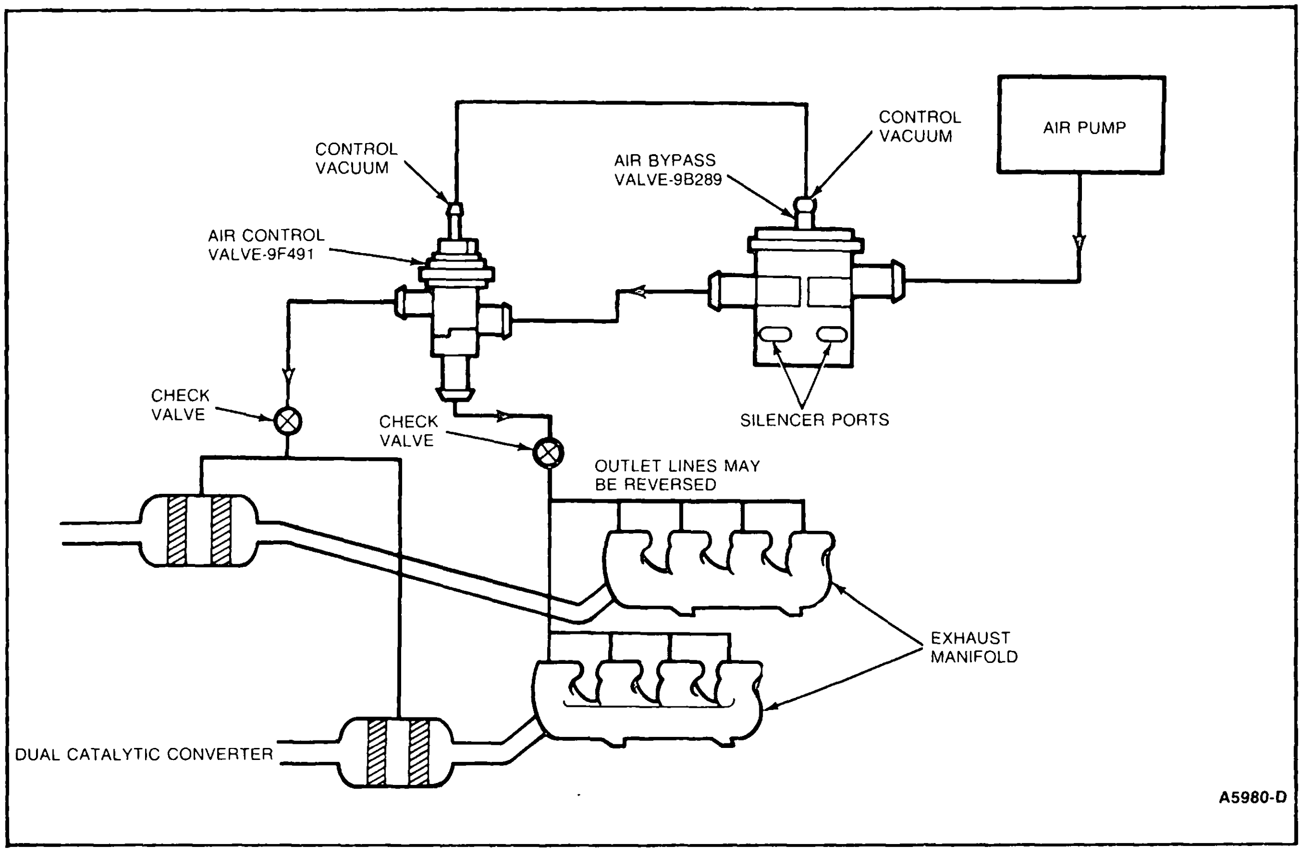

Figure 1 Typical Managed Air Thermactor System

Thermactor Systems (Secondary Air Injection)

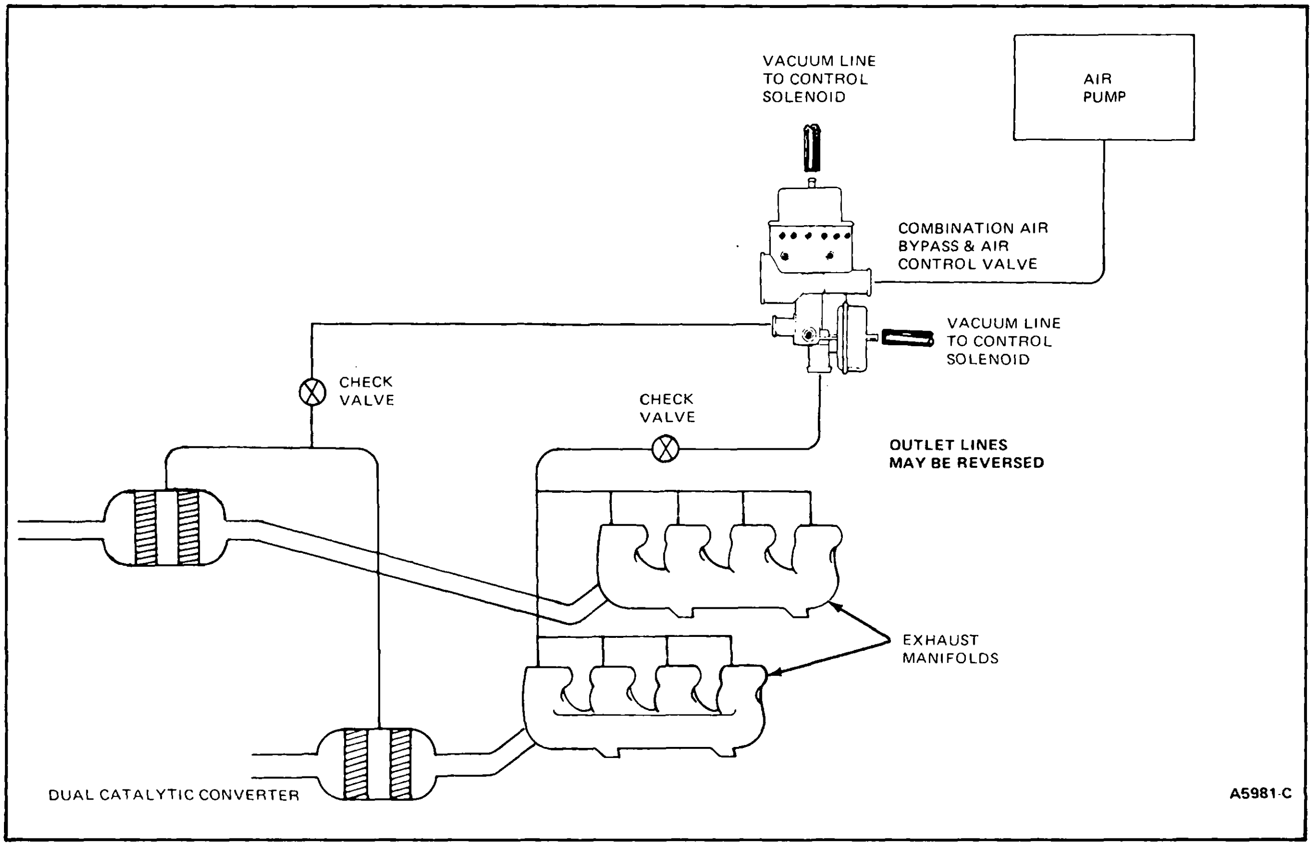

Figure 2 Managed Thermactor Air System with Combined Bypass/Control Valve—Electronically Controlled

Thermactor Systems (Secondary Air Injection)

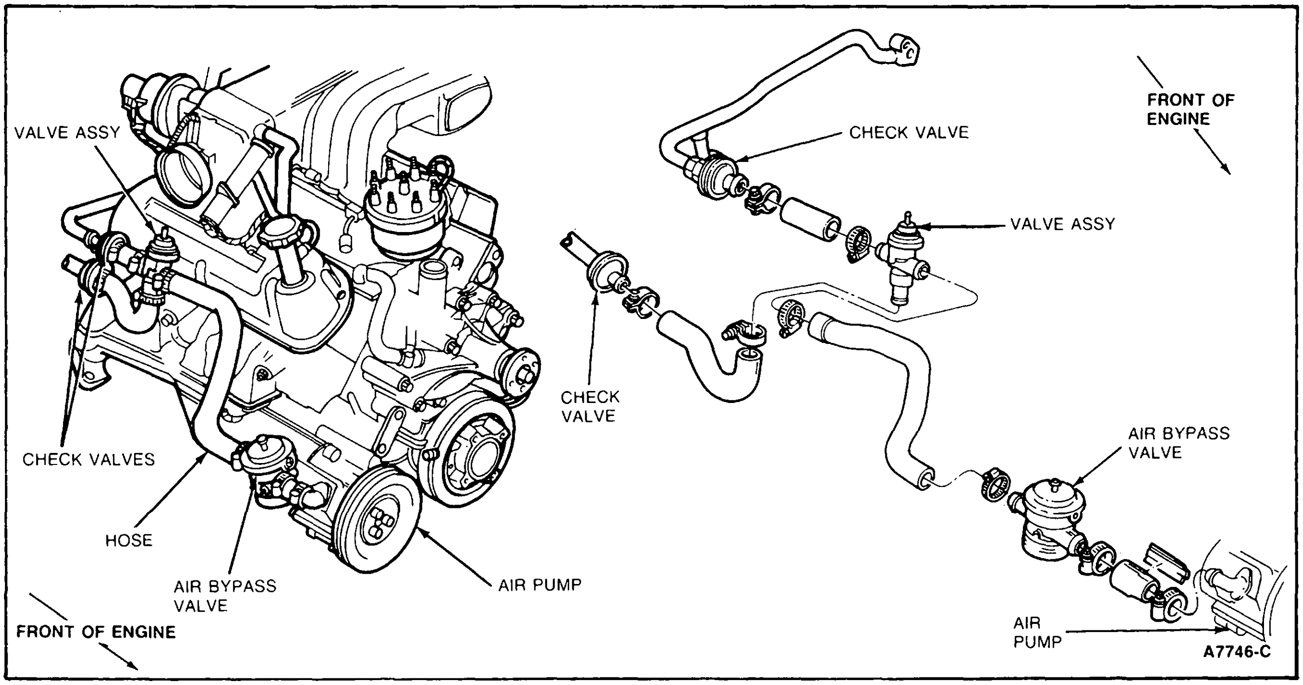

Figure 3 Locations of Thermactor Valves—5.0L Engine (Passenger Car)

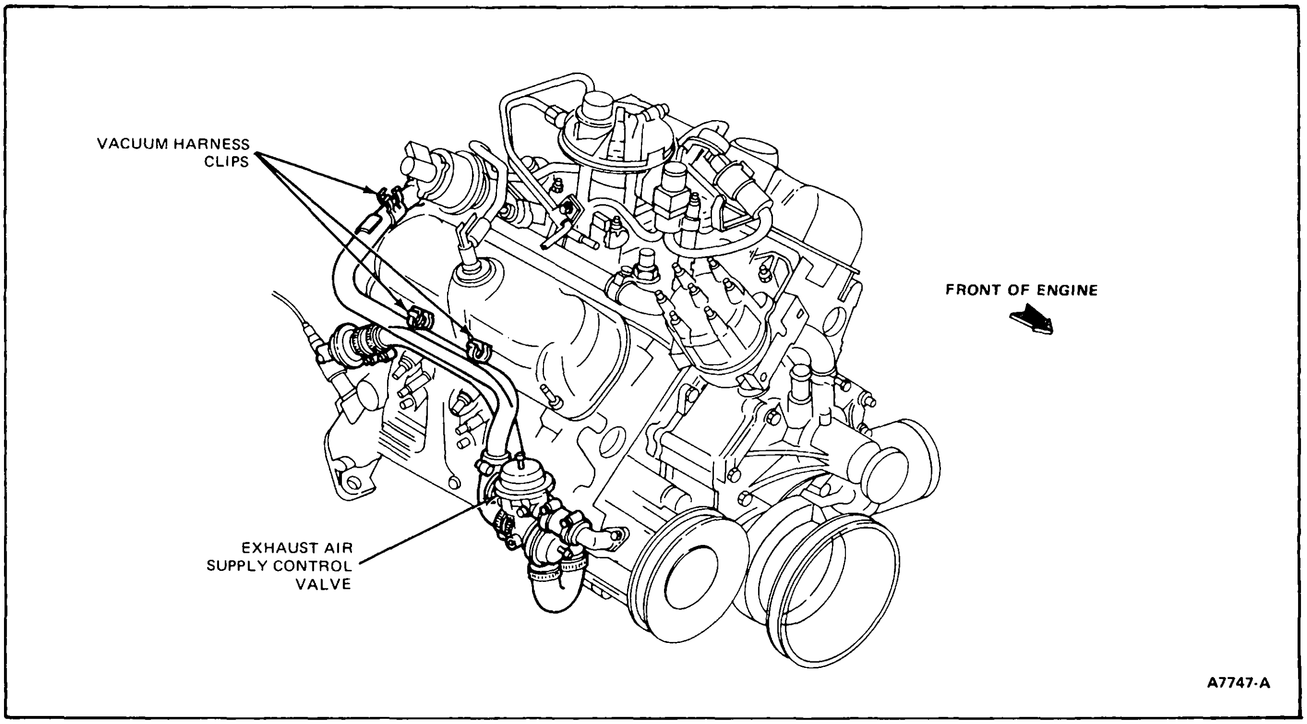

Figure 4 Locations of Thermactor Valves—3.8L CFI Engine Mustang, Thunderbird/Cougar, 3.8L Engine (CFI Only)

Thermactor Systems (Secondary Air Injection)

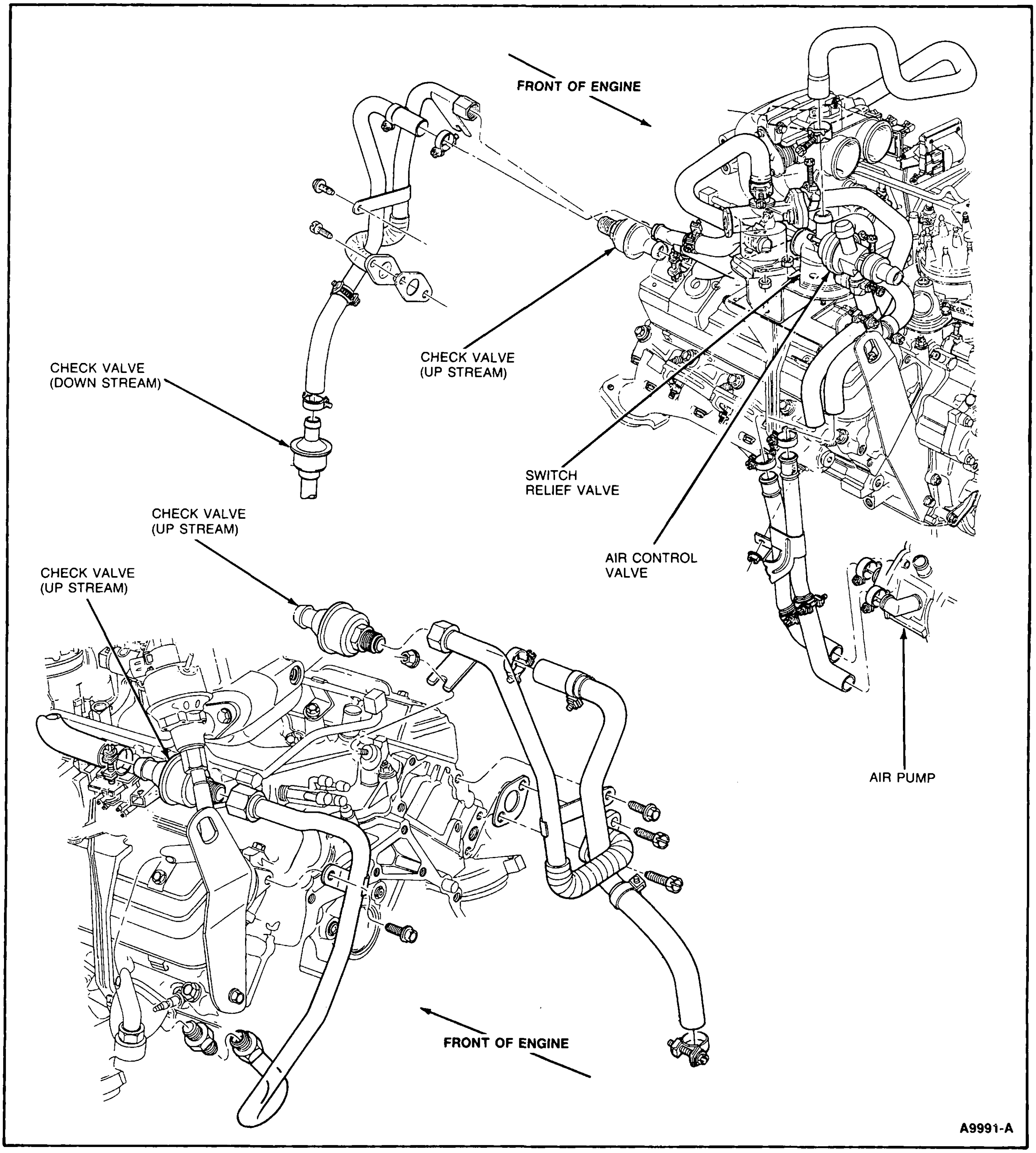

Figure 5 Managed Thermactor Air System—Location of Thermactor Valves—7.5L EFI Heavy Duty Truck

Thermactor Systems (Secondary Air Injection)

Dual Air Pump System

Heavy Duty Trucks

The Thermactor system for V-8 heavy duty trucks utilizes two air pumps and two bypass valves to direct air simultaneously to the cylinder head check valve, and to the left and right hand exhaust manifold check valves. The system will also dump air to the air cleaner during decel modes and at high speed, high back pressure modes, Figure 6.

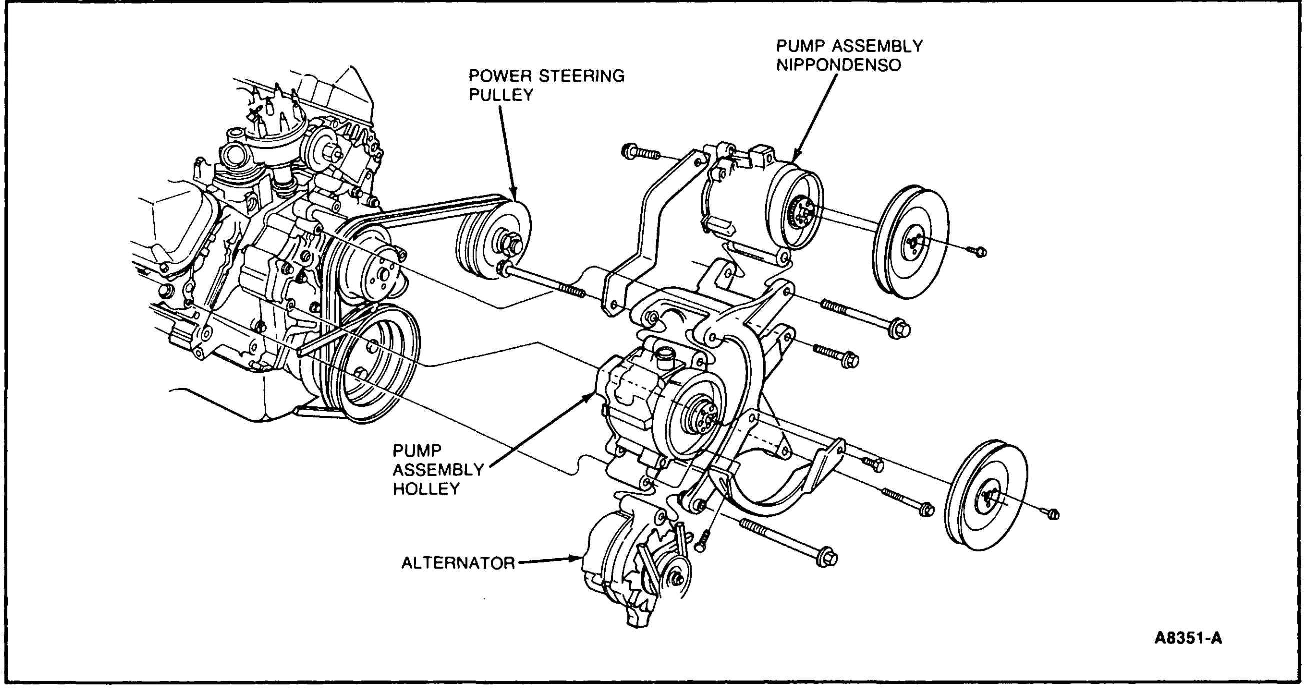

Figure 6 Dual Air Pump System—49S, 5.8L and 7.5L-4V Engines (Heavy Duty Trucks)

Diagnosis

1. Inspect the belt drive system and air distribution system to ensure that they are in place and operating. Refer to Noise Test and Belt Adjustment in this Section.
2. Check out individual components, refer to Section 3.

Thermactor Systems (Secondary Air Injection)

Pulse Air System (Thermactor II)

Description

Some engines are equipped with an air injection system called pulse air or Thermactor II, Figure 7. The system does not use an air pump. The system uses natural pulses present in the exhaust system to pull air into the exhaust manifold and/or catalyst through pulse air valves. The pulse air valve is connected to the exhaust manifold and/or catalyst with a long tube and to the air cleaner or silencer with a hose.

Diagnosis

1. Check that air can flow freely through the air cleaner or silencer to the check valve.
2. The check valve diagnostic is in Section 3.

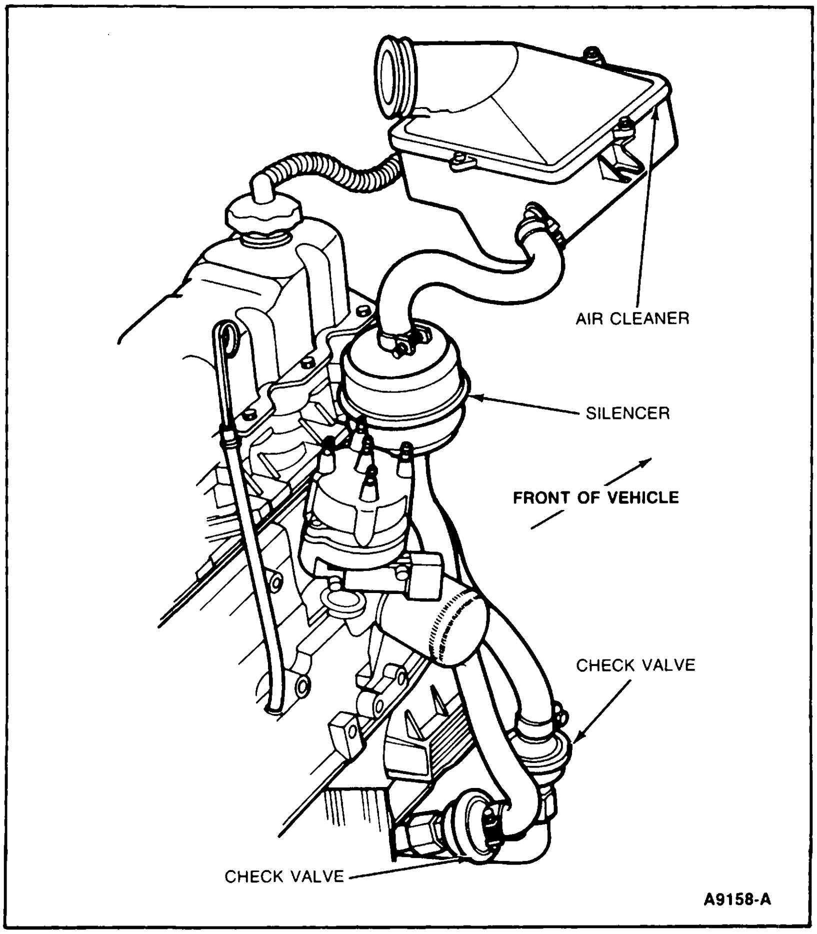

Figure 7 Pulse Air System (Thermactor II)—Typical

Thermactor Systems (Secondary Air Injection)

Extended Idle Air Bypass System

Functional Check: 2.3L HSC Engine, Canada

Refer to Figure 8.

With the engine warmed up, allow the engine to return to idle position, then begin timing. If, after 30 seconds, the thermactor bypass valve dumps secondary air through the vents, the system is OK. If not, check routing and condition of the air hose and vacuum lines.

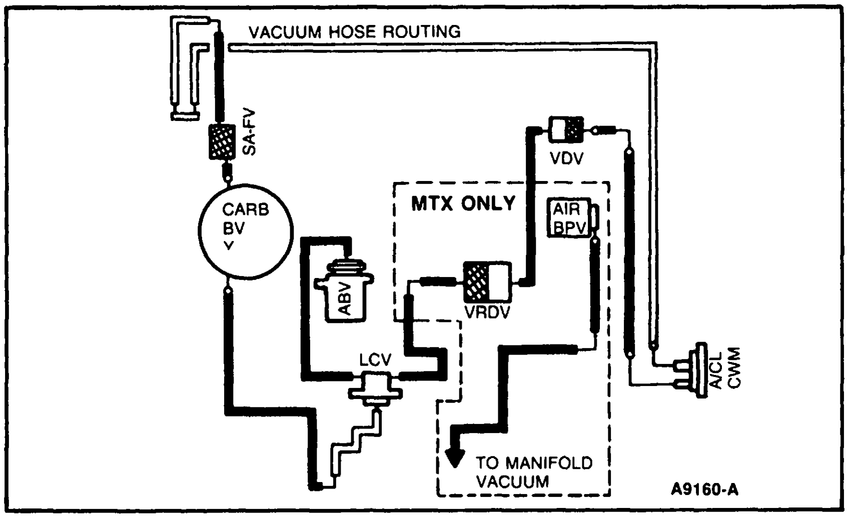

Figure 8 Extended Idle Air Bypass System—2.3L HSC Engine, Canada

Thermactor Systems (Secondary Air Injection)

Thermactor System Noise Test

NOTE: Do not service vehicle for noise condition unless pump has had 804.5 km (500 miles) in service for break-in.

CAUTION: Do not use a pry bar to move the air pump for belt adjustment.

NOTE: The thermactor system is not completely noiseless. Under normal conditions, noise rises in pitch as engine speed increases. To determine if noise is the fault of the air injection system, disconnect the belt drive (only after verifying that belt tension is correct), and operate the engine. If the noise disappears, proceed with the following diagnosis.

Diagnosis

CONDITION	POSSIBLE SOURCE	ACTION
Excessive Belt Noise	• Loose belt	• Tighten to specification using Tool T75L-9480-A or equivalent to hold belt tension and Belt Tension Gauge T63L-8620-A or equivalent. **CAUTION: Do not use a pry bar to move air pump.**
	• Seized pump	• Replace pump.
	• Loose pulley	• Replace pulley and/or pump if damaged. Tighten bolts to 13.6-17.0 N•m (120-150 lb-in).
	• Loose or broken mounting brackets or bolts	• Replace parts as required and tighten bolts to specification.
• Excessive Mechanical Clicking	• Overtightened mounting bolt	• Tighten to 34 N•m (25 lb-ft).
	• Overtightened drive belt	• Same as loose belt.
	• Excessive flash on the air pump adjusting arm boss	• Remove flash from the boss.
	• Distorted adjusting arm	• Replace adjusting arm.

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Thermactor Systems (Secondary Air Injection)

CONDITION	POSSIBLE SOURCE	ACTION
Excessive Thermactor System Noise (Putt-Putt, Whirling or Hissing)	Leak in hose	Locate source of leak using soap solution, and replace hoses as necessary.
	Loose, pinched or kinked hose	Reassemble, straighten, or replace hose and clamps as required.
	Hose touching other engine parts	Adjust hose to prevent contact with other engine parts.
	Bypass valve inoperative	Test the valve.
	Check valve inoperative	Test the valve.
	Pump or pulley mounting fasteners loose	Tighten fasteners to specification.
	Restricted or bent pump outlet fitting	Inspect fitting, and remove any flash blocking the air passage way. Replace bent fittings.
	Air dumping through bypass valve (at idle only)	On many vehicles, the thermactor system has been designed to dump air at idle to prevent overheating the catalyst. This condition is normal. Determine that the noise persists at higher speeds before proceeding.
	Air dump through bypass valve (decel and idle dump)	On many vehicles, the thermactor air is dumped in air cleaner or in remote silencer. Make sure hoses are connected and not cracked.
Excessive Pump Noise (Chirps, Squeaks and Ticks)	Insufficient break-in or worn or damaged pump	Check the thermactor system for wear or damage and make necessary corrections. If pump is not damaged and has less than 804.5 Km (500 miles) in service, do NOT replace pump. A 804.5 Km (500 mile) break-in is required.

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Thermactor Air Pump Drive Belt Adjustment

1. Check all air pump pulleys and mounting bolts, and tighten to specification, if required.

2. Install the belt tension gauge (Tool T63L-8620-A or equivalent) on the drive belt, and check the tension. Compare the belt tension to the specified belt tension and adjust as necessary.

3. If adjustment is necessary, loosen the air pump mounting and adjusting arm bolts, move the air pump toward or away from the engine until the correct tension is obtained. Use air pump belt tensioning tool (Tool T75L-9480-A or equivalent) to hold belt tension while tightening the mounting bolts. Install the tension gauge, and check the belt tension.

CAUTION: Do not use a pry bar.

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SECTION 11

Fuel Delivery Systems

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Specifications (Mechanical Fuel Pump Systems) 11-3

Fuel Pressure Regulator Diagnostics (EFI Systems) 11-4

Fuel Delivery Systems

FUEL DELIVERY SYSTEM DIAGNOSTICS WITH MECHANICAL FUEL PUMP

CAUTION: USE CARE TO PREVENT COMBUSTION FROM FUEL SPILLAGE

DRIVEABILITY SYMPTOM MENU	
201	CRANKS NORMALLY BUT WON'T START
202	STARTS NORMALLY BUT WON'T RUN (STALLS)
203	CRANKS NORMALLY BUT SLOW TO START
205	MISSES UNDER LOAD
207	HESITATES OR STALLS ON ACCELERATION
208	BACKFIRE (INDUCTION OR EXHAUST)
209	LACK OF POWER
210	SURGES AT STEADY SPEED
220	GAS SMELL

Pre-checks

- Inspect all hoses, fuel lines & fuel tanks for deformities, kinks & leaks.
- Check fuel pump for fuel leaks.
- Check for adequate fuel supply in fuel tank.

Fuel Delivery Systems

INTEGRITY CHECK (MECHANICAL FUEL PUMPS)

TEST STEP		RESULT ▶	ACTION TO TAKE
FDM1	PRESSURE AND CAPACITY (VOLUME) TEST		
	○ Check fuel pressure and capacity at the fuel filter inlet. Save ALL sample fuel for FDM3. Use a clear plastic container that is fuel resistant and a pressure gauge that reads a minimum of 10 psi and attached specifications. (Refer to Footnotes 2 and 3). ○ For 2.3L HSC engines check fuel pump pushrod length (2.45 to 2.47 inches) and check for cam lobe wear prior to fuel pump replacement. NOTE: For NO-START ENGINE CONDITION perform FDM1 at cranking speed. See 10 second cranking specifications for minimum pressure and volume.	Pressure and volume NOT OK ▶	GO to **FDM2**.
		Pressure OK Volume not OK ▶	REPLACE fuel pump or SERVICE as necessary and REPEAT **FDM1**. If OK, GO to **FDM3**.
		Pressure and volume OK ▶	GO to **FDM3**.
FDM2	AUXILIARY FUEL SUPPLY TEST		
	Use an AUXILIARY fuel container and repeat capacity (volume) check, FDM1. Use a container approved for fuel storage.	Volume OK ▶	GO to **FDM5**.
		Volume NOT OK ▶	REPLACE fuel pump. GO to **FDM1**.
FDM3	FUEL CONTAMINATION TEST		
	Examine the sample fuel carefully (including the bottom of container) in a clear container for particles or other liquids contaminates, such as water.	NO contamination ▶	GO to **FDM4**.
		Contamination (any amount) FOUND ▶	GO to **FDM6**.
FDM4	FUEL FILTER TEST		
	○ REPEAT pressure and capacity test AFTER the in-line fuel filter. If the fuel filter is integral to the carburetor, inspect the fuel filter for contamination. Tap filter (inlet side down) on a clean surface.	Filter OK ▶	Fuel delivery system OK.
		Filter clogged or contaminated ▶	REPLACE FUEL FILTER. GO to **FDM5**.
FDM5	FUEL LINE TEST		
	Disconnect fuel line at fuel tank and fuel pump inlet. ○ Check fuel for restrictions by applying house air (not to exceed 20 to 25 psi). ○ Check for improper gas fill cap (vacuum/pressure) and fuel tank ventilation.	Fuel line OK ▶	GO to **FDM6**.
		Fuel line NOT OK ▶	SERVICE as required and GO to **FDM1**.

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Fuel Delivery Systems

INTEGRITY CHECK (MECHANICAL FUEL PUMPS)

TEST STEP		RESULT ▶	ACTION TO TAKE
FDM6	FUEL TANK TEST		
	• Lower fuel tank and flush tank and fuel lines. Replace ALL fuel filters. Check sender unit filter.	Fuel tank OK ▶	GO to **FDM4**.
		Fuel tank NOT OK ▶	SERVICE as required and GO to **FDM4**.

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SPECIFICATIONS (MECHANICAL FUEL PUMP SYSTEMS)

			NO START ENGINE CONDITION ONLY	
ENGINE	PRESSURE (psi) ① ② ⑤	MIN. VOLUME FLOW ① ③	10 SECOND CRANKING SPECS. FOR MIN. PRES. (psi) & VOL. (pt) ② ④	
2.0L	5.0-7.0	1 pt. in 25 sec.	5.0	0.25
2.3L HSC	5.0-7.0	1 pt. in 25 sec.	5.0	0.25
5.8L	6.0-8.0	1 pt. in 20 sec.	6.0	0.3
7.5L	6.0-8.0	1 pt. in 20 sec.	6.0	0.3

FOOTNOTES

① Engine at operating temperature, manual transmission in NEUTRAL, automatic transmission in PARK, parking brake engaged and engine at curb idle speed.

② Close off the fuel return line, if so equipped. Fuel return lines are found at the fuel pump fuel filter, carburetor or on the fuel flow sensor on vehicles equipped with tripminder.

③ Inside diameter of the smallest passage in the test equipment flow circuit must not be smaller than 0.220 inch.

④ A steady 10 seconds of cranking time required with a fully charged battery.

⑤ Before taking a pressure reading, operate the engine and purge the fuel system into the fuel pump tester container for approximately five seconds.

***For additional information refer to Shop Manual Sections 24-30, 24-50 and 24-51.**

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Fuel Delivery Systems

FUEL PRESSURE REGULATOR DIAGNOSTICS (EFI SYSTEMS)

TEST STEP		RESULT ▶	ACTION TO TAKE
FDE1	DE-PRESSURIZE SYSTEM • Remove fuel tank cap. • Install tool T80L-9974-B or equivalent at the Schrader (fuel relief) Valve on the fuel rail. • Continue on to FDE2.		
FDE2	DIAPHRAGM INTEGRITY CHECK • Start engine, run for 10 seconds. • Turn engine off for 10 seconds. • Repeat above Steps (This is to activate fuel pump and pressurize the fuel rail). • Remove vacuum line at the fuel pressure regulator valve. • Observe if fuel exits the regulator at the vacuum port.	Yes ▶	REPLACE fuel pressure regulator. Check oil for fuel contamination. CHANGE oil and filter if signs of fuel are present (smell of fuel in oil or oil with water-like texture).
		NO ▶	GO to **FDE3**.
FDE3	PRESSURE CHECK-REGULATOR VALVE • Reconnect vacuum line at fuel pressure regulator valve. • Start and run engine for 30 seconds. • Turn engine off. • Fuel pressure must not drop more than 34 kPa (5 psi) after 60 seconds.	Within specification ▶	GO to **FDE4**.
		Not within specification ▶	CHECK for line leaks (both fuel and vacuum).
FDE4	VALVE SEAT LEAKAGE CHECK • Relieve pressure in fuel rail. • Remove fuel pressure regulator valve. • Inspect gasket and O-ring for cracks and cuts. • Connect vacuum gauge to the fuel return tube (7/32-inch diameter tube is centered on baseplate). • Apply 20 inches Hg. of vacuum. • Vacuum must not drop below 10 inches Hg. in 10 seconds.	OK ▶	REINSTALL fuel pressure regulator. REFER to other drive/ symptom problems (Section 2).
		Not OK ▶	REPLACE fuel pressure regulator.

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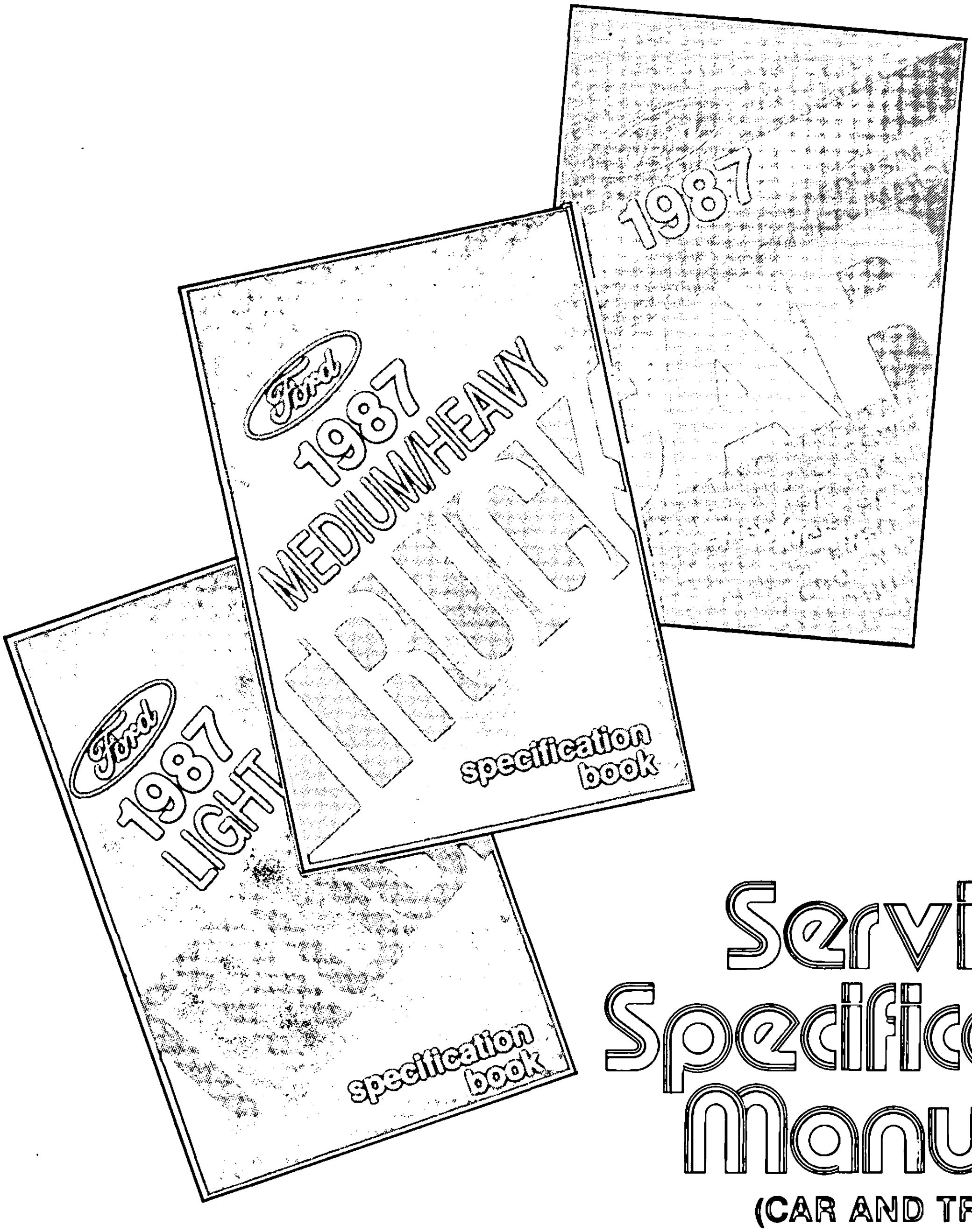

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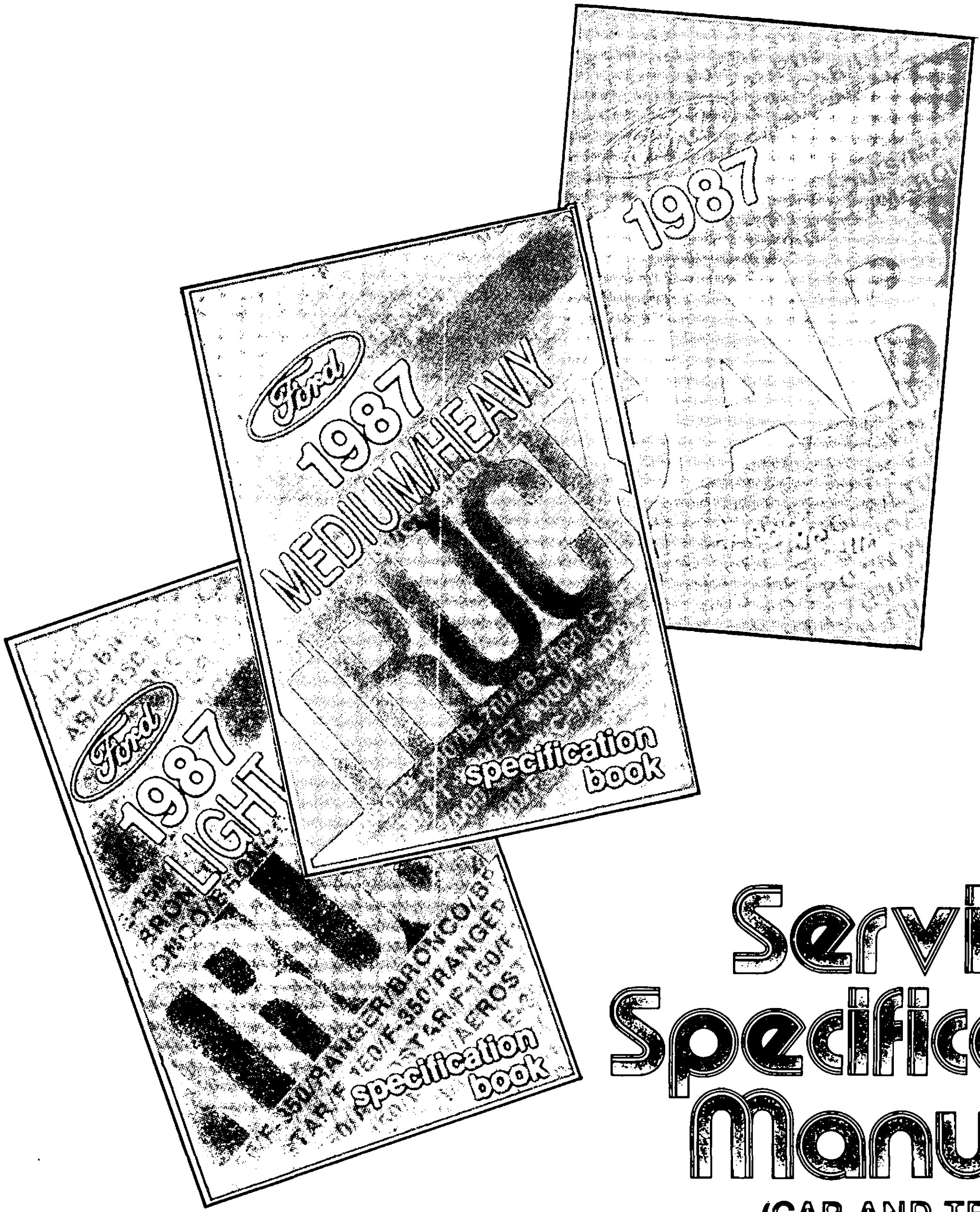

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Glossary

Contents

Glossary 12-1

Glossary

The glossary is a list of technical terms or acronyms and their definitions. It is not intended to be a dictionary of components and their functions. If you desire a detailed description of a specific component, please refer to Section 3, Emission Related Components, in this manual.

A/C: Air Conditioning.

ACCS: A/C Cycling Switch.

ACL: Automatic Adjustable Shock Controller.

A/CL BIMET: Air Cleaner Bimetal sensor.

A/C DV: Air Cleaner Duct and Valve motor.

ACC: A/C Clutch Compressor signal input to the EEC-IV processor relating status of the A/C clutch.

ACD: Air Conditioner Demand switch.

ACT: Air Charge Temperature sensor or its signal circuit.

ACV: (Thermactor) Air Control Valve.

AHFSS: Air Condition/Heater Function Select Switch input to the EEC-IV processor relating status of the A/C heater function select switch.

AIR BPV: (A Thermactor) Air Bypass Valve.

AM1: Thermactor Air Management 1 (TAB).

AM2: Thermactor Air Management 2 (TAD).

AMBIENT TEMPERATURE: Temperature of air surrounding an object e.g., temperature where vehicle is being worked on.

ANTI-BFV: Anti-Backfire Valve.

AVOM: Analog Volt-Ohm Meter.

AXOD: Automatic Transaxle Overdrive.

AXOD-E: Automatic Transaxle Overdrive, Electronically Controlled.

BASE IDLE: Idle RPM determined by throttle lever hardset on throttle body while Idle Speed Control is fully retracted and disconnected.

BOB: (Breakout Box) An EEC-IV test device which connects in series with the processor and the EEC-IV harness and permits measurements of processor inputs and outputs.

BOO: Brake On-Off input to the EEC-IV processor indicating a braking drive mode.

BOOST: Turbo charger boost solenoid or its control circuit.

BP: Barometric Pressure sensor or its signal circuit.

BV: Bowl Vent (Carburetor Fuel Bowl).

CANP: Canister Purge solenoid or its control circuit.

CATALYST: A muffler like device in the exhaust system containing a monolithic substrate (a ceramic honeycomb structure) that is coated with catalytic metals such as platinum or palladium. When hot exhaust gases come in contact with these metals a chemical reaction takes place to consume unburned hydrocarbon, carbon monoxide and nitrous oxides.

CCO: Converter Clutch Override output from the EEC-IV processor to the transmission.

CFI: (Central Fuel Injection) A computer controlled fuel metering system which sprays atomized fuel into a throttle body mounted atop the intake manifold.

CLUTCH: Clutch engagement switch or its control circuit.

COC: Conventional Oxidation Catalyst.

COMPUTER TIMING: The total spark advance in degrees before top dead center. Calculated by the EEC-IV processor based on input from a number of sensors.

CURB IDLE: Computer controlled Idle RPM.

CWM: Cold Weather Modulator.

DFS: Decel Fuel Shut-off.

DOL: (Data Output Link) Fuel calculation data from the EEC-IV processor to the electronic tripminder.

DV: Delay Valve.

DVOM: Digital Volt-Ohm Multimeter that displays voltage or resistance measurements in digital form on a liquid crystal display (LCD).

DV TW: Delay Valve Two Way.

Glossary

ECA: Electronic Control Assembly.

ECT: Engine Coolant Temperature sensor or its signal circuit.

EDF: Electro-Drive Fan relay or its control circuit.

EEC: (Electronic Engine Control) A computer controlled system of engine control.

EEGR: Electronic EGR Valve (Sonic).

EFI: (Electronic Fuel Injection) A computer controlled fuel system that distributes atomized fuel through an injector located in each intake port of the engine.

EGO: Exhaust Gas Oxygen sensor or its signal circuit.

EGOG: EGO Ground.

EGR: Exhaust Gas Recirculation system designed to allow the flow of inert exhaust gases into the combustion chamber to cool the combustion and thus reduce nitrous oxides in the exhaust.

EGR S/O: EGR Shut Off.

EGRC: EGR Control vacuum solenoid valve or its control circuit.

EGRV: EGR Vent vacuum solenoid valve or its control circuit.

EHC: Exhaust Heat Control vacuum solenoid valve or its control circuit.

EVP: EGR Valve Position sensor or its signal circuit.

EVR: EGR Valve Regulator vacuum solenoid valve or its control circuit.

FBC: (Feedback Carburetor) An MCU or EEC-IV controlled fuel system employing a stepper motor or a dithering solenoid that controls fuel/air mixture by bleeding air into the main and idle systems of the carburetor.

FCS: Fuel Control Solenoid or its control circuit.

FI: Fuel Injector or its control circuit.

FP: Fuel Pump relay or its control circuit.

FUEL RICH/LEAN: A qualitative evaluation of air/fuel ratio based on an A/F value known as stoichiometry or 14.7. In the EEC-IV system rich/lean is determined by a voltage signal from the EGO sensor. An excess of oxygen (lean) is an EGO voltage of less than .4 volts, a rich condition is indicated by an EGO voltage of greater than .6 volts.

GND or GRND: A common ground circuit for all vehicle power.

HALL EFFECT: A process where current is passed through a small slice of semi-conductor material at the same time as a magnetic field to produce a small voltage in the semi-conductor.

HBV: Heater Blower Voltage input to the EEC-IV processor reflecting heater blower voltage demand.

HEDF: High speed Electro-Drive Fan relay or its control circuit.

HEGO: Heated EGO sensor or its signal circuit.

HEGOG: Heated EGO Ground.

HIC: Hot Idle Compensator.

HO: High Output.

HSC: High Swirl Combustion.

IBP: Integral Backpressure.

IAS: Inlet Air Solenoid valve or its control circuit.

IDLE LIMITER: A device to control minimum and maximum idle fuel richness. The idle limiter is intended to prevent unauthorized persons from making overly rich idle adjustments.

IDM: (Ignition Diagnostics Monitor) A continuous monitor of the ignition input to the EEC-IV processor used to detect intermittent ignition faults.

IMS: (Inferred Mileage Sensor) A circuit using a E-cell which deflates its state with the application of a current. As the vehicle ages (in terms of key on time) the EEC-IV processor compensates for aging of the vehicle by changing calibration parameters.

INJ: Injector (Fuel).

INJ GND: Injector Ground (Fuel).

ISC: (Idle Speed Control) Currently there are three types of computer controlled idle speed control: D.C. motor ISC, air bypass ISC, and throttle kicker ISC.

Glossary

ITS: Idle Tracking Switch.

KAM: (Keep Alive Memory) A series of vehicle battery powered memory locations in the microprocessor which allows the microprocessor to store input failures identified during normal operation for use in later diagnostic routines and adopts some calibration parameters to compensate for changes in the vehicle system.

KAPWR: Keep Alive Power.

KS: Knock Sensor or its signal circuit.

L: Liters.

LOS: (Limited Operation Strategy) Certain types of computer malfunction will place the EEC-IV processor into LOS mode. Output commands are replaced with fixed valves.

LUS: Lock Up Solenoid.

MAP: Manifold Absolute Pressure sensor or its signal circuit.

MCU: Microprocessor Control Unit.

NDS: Neutral Drive Switch and its signal circuit.

NGS: Netrual Gear Switch or its signal circuit.

NPS: Neutral Pressure Switch.

OCC: Output Circuit Check.

OCT: Octane Switch.

OPEN CIRCUIT: A circuit which does not provide a complete path for the flow of current.

OSC: Output State Check.

PCV: (Positive Crankcase Ventilation) A system which controls the flow of crankcase vapors into the engine intake manifold where they are burned in combustion rather than being discharged into the atmosphere.

PFE: Pressure Feedback EGR sensor or its signal.

PIP: (Profile Ignition Pickup) a "hall effect" vane switch that furnishes crankshaft position data to the EEC-IV processor.

PSPS: (Power Steering Pressure Switch) An EEC-IV processor input to regulate idle speed based on power steering load demand.

PULSE AIR SYSTEM: Part of the emission control system that utilizes a reed-type check valve which allows air to be drawn into the exhaust system as a result of exhaust pulses.

PVS: Ported Vacuum Switch.

PWR GND: Power Ground.

QUICK TEST: A functional diagnostic test of the EEC system consisting of vehicle preparation and hookup, key on engine off, engine running and continuous self-tests.

RELAY: A switching device operated by a low current circuit which controls the opening and closing of another circuit of higher current capacity.

RELIEF VALVE: A pressure limiting valve located in the exhaust chamber of the thermactor air pump. It functions to relieve part of the exhaust airflow if the pressure exceeds a calibrated value.

SEFI: (Sequential Electronic Fuel Injection) Port fuel injection triggered off ignition timing that fires each injector separately.

SDV: Spark Delay Valve.

SHED: Sealed Housing Evaporative Determination System.

SIG RTN: Signal Return circuit for all sensor signals except EGO.

SIL: (Shift Indicator Light) A system that provides a visual indication to the driver of a vehicle when to shift to the next higher gear to obtain optimum fuel economy.

SOLENOID: A wire coil with a moveable core that changes position by means of electro-magnetism when current flows through the coil.

SPOUT: Spark Output Signal from the EEC-IV processor that triggers the TFI-IV module to fire the ignition coil.

SS 3/4-4/3: (Shift Solenoid 3/4-4/3) Output from the EEC-IV processor to the transmission that selects 3rd and 4th gears.

Glossary

STAR: (Self Test Automatic Readout) A testing device in which the EEC and MCU systems output service codes in a digital format.

STI: Self Test Input circuit in the EEC and MCU systems used to initate self test.

STO: Self Test Output circuit in the EEC and MCU systems that transmits service codes (pulses) to either a VOM or star tester.

SVO: Special Vehicle Operations.

TAB/TAD: Thermactor Air Bypass/Thermactor Air Diverter vacuum solenoid valves or their control circuits.

TCP: Temperature Compensated (Acceleration) Pump.

TFI: (Thick Film Ignition) Distributor mounted module comprised of a custom integrated circuit, Darlington output device and associated thick film integrated components.

TGS: (Top Gear Switch) A lock out mechanism that prevents the SIL from lighting when the vehicle is in top gear.

THERMACTOR: A system for injection of air into the exhaust system to aid in the control of hydrocarbon and carbon monoxides in the exhaust.

THERMACTOR II: See Pulse Air System.

THS: Transmission Hydraulic Switch.

THS 3/2: Transmission Hydraulic Switch - 3rd/2nd gear.

THS 4/3: Transmission Hydraulic Switch - 4th/3rd gear.

TIMING: Relationship between spark plug firing and piston position usually expressed in crank shaft degrees before (BTDC) or after (ATDC) top dead center of the compression stroke.

TIV: Thermactor Idle Vacuum Valve.

TK: Throttle Kicker vacuum solenoid valve or its control circuit.

TP: Throttle Position sensor or its signal circuit.

TSP: Throttle Solenoid Positioner.

TVS: Temperature Vacuum Switch.

TVV: Thermal Vent Valve.

TWC: Three Way Catalyst.

VAF: Vane Air Flow sensor or its signal circuit.

VAT: Vane Air Temperature sensor or its signal circuit.

VBATT: Vehicle Battery voltage.

VCV: Vacuum Check Valve.

VDV: Vacuum Delay Valve.

VM: Vane Meter.

VOM: Volt-Ohm Meter used to measure voltage and resistance. Readings are indicated by sweep hand on a printed scale rather than a digital display.

VOTM: Vacuum Operated Throttle Modulator.

VPWR: Vehicle Power supply voltage regulated to 10-14 volts.

VR/S: Vacuum Regulator/Solenoid.

VRDV: Vacuum Retard Delay Valve.

VREF: Reference voltage supplied by the EEC-IV processor to some sensors and regulated to 4-6 volts.

VRESER: Vacuum Reservoir.

VREST: Vacuum Restrictor.

VRV: Vacuum Regulator Valve.

VSC: Vehicle Speed Control sensor or its signal circuit.

VSS: Vehicle Speed Sensor or its signal circuit.

VVA: Venturi Vacuum Amplifier.

VVC: Variable Voltage Choke relay or its control circuit.

VVV: Vacuum Vent Valve.

WAC: Wide (open throttle) A/C Cutoff.

WOT: Wide Open Throttle.

ENGINE/EMISSIONS DIAGNOSIS

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OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS

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- Available in the first quarter of the model year. (One manual for each passenger car and light truck family.)

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(CAR AND TRUCK)

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SECTION 13

Emission Maintenance Warning Light

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Application, Description and Operation

VEHICLE APPLICATION

All 1987 49 state Aerostar, Econoline, F-Series, Bronco, Ranger, Bronco II Light Trucks and all 1987 49 state Medium and Heavy Duty Trucks. (Gasoline engines only.)

DESCRIPTION AND OPERATION

The Emission Maintenance Warning (EMW) Light System consists of an instrument panel mounted amber lens (with the word EGR, EMISS or EMISSIONS printed on it) that is electrically connected to a sensor module located under the instrument panel. The purpose of the system is to alert the customer that 60,000 mile emission system maintenance is required on the vehicle. Specific emission system maintenance requirements are shown in the vehicle Owner's Guide (Medium and Heavy Duty Truck) or the vehicle Maintenance Schedule and Record Log (Light Trucks).

The EMW Light module actually measures accumulated vehicle ignition Key-on time and is designed to continuously close an electrical circuit to the amber lens after 2000 hours of vehicle operation. Assuming an average vehicle speed of 30 mph, the 2000 hours equates to 60,000 miles of vehicle operation. Acutal vehicle mileage intervals will vary considerably as individual driving habits vary.

Note that when the ignition key is initially placed in the On position, the EMW system microprocessor will activate the amber lens for 2 to 5 seconds to indicate proper function of the system. When approximately 60,000 miles of vehicle operation is reached, the EMW light will remain on continuously, indicating that emission system maintenance is required. After the vehicle's emission system maintenance has been performed, the technician should reset the sensor for another 60,000 mile period.

When To Use This Diagnostic Procedure

Emission maintenance should be performed if the emission maintenance warning light is on continuously and either of the following is true:

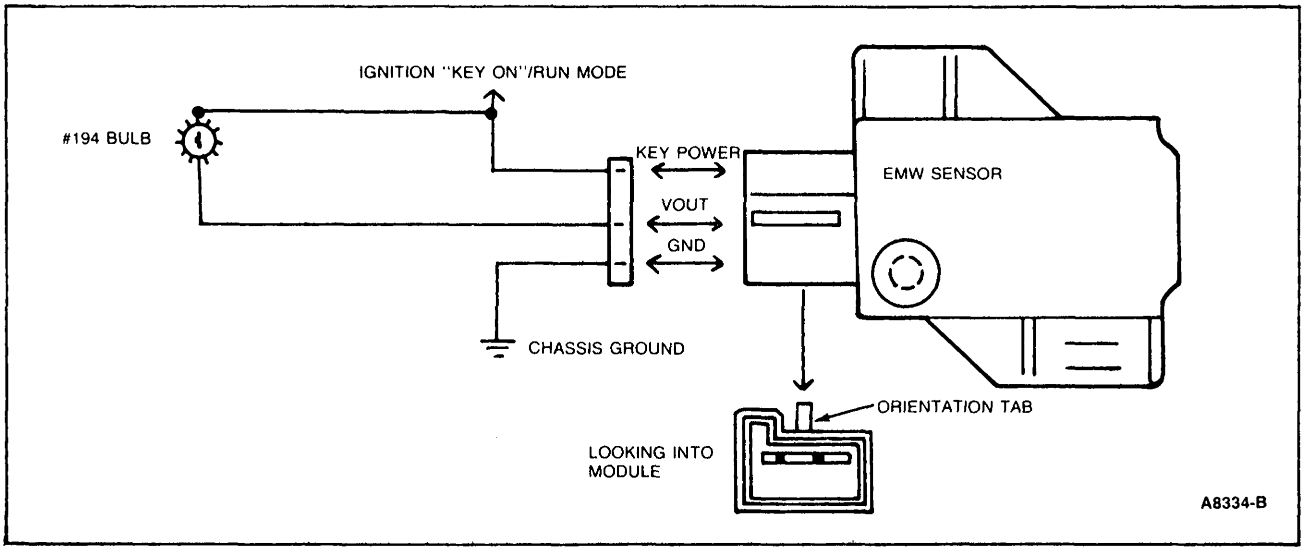
- Mileage is between 45,000 and 75,000 miles with no previous emission maintenance.
- Mileage is greater than 105,000 miles.

Use this procedure only when the specified mileage does not apply or if the EMW module cannot be reset after emission maintenance is completed.

Emission Maintenance Warning Light (EMW)

SYSTEM SCHEMATIC

Ranger, Bronco II, Aerostar Light Trucks and Medium and Heavy Duty Trucks



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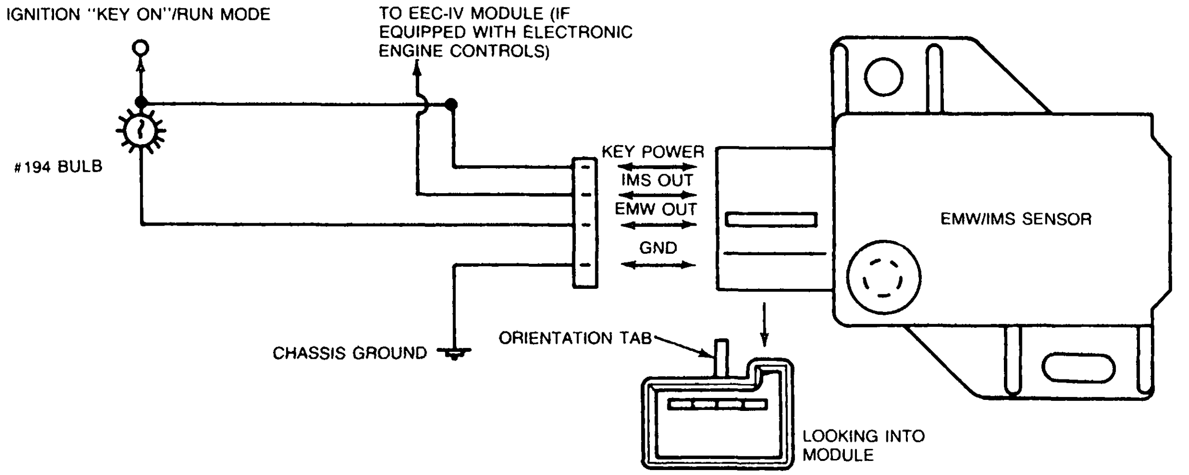
SYSTEM SCHEMATIC

Econoline, F-Series, Bronco Light Trucks



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Emission Maintenance Warning Light (EMW)

Pinpoint Test

EM

TEST STEP	RESULT	ACTION TO TAKE
EM1 VERIFY EMW LIGHT STATUS		
• Key Off. • Turn key to On position. • Does EMW light come ON for 2-5 seconds and go Off?	YES ▶	System OK.
	NO ▶	GO to EM2.
EM2 CHECK MODULE POWER		
• EMW connected. • Key On. • DVOM, Rotunda 007-00001 or equivalent, on 20V scale. • Measure voltage between keypower and ground circuits at the EMW sensor. • Is voltage greater than 10.5V?	YES ▶	GO to EM3.
	NO ▶	SERVICE open in KEYPOWER or ground circuit.
EM3 CHECK SENSOR OUTPUT		
• Key Off. • DVOM on 20V scale. • EMW connected. • Turn key On. • Measure voltage between keypower and vout circuits at the EMW sensor. • Voltage is greater than 10.5 volts for 2-5 seconds and then drops to less than 4.0 volts.	YES ▶	GO to EM4.
	NO ▶	GO to EM5.

Emission Maintenance Warning Light (EMW)

Pinpoint Test

EM

TEST STEP	RESULT	ACTION TO TAKE
EM4 CHECK CONTINUITY KEYPOWER AND VOUT CIRCUITS		
● Key Off. ● Disconnect EMW sensor. ● DVOM 200 OHM scale. ● Measure resistance between KEYPOWER terminal and EMW bulb. ● Measure resistance between vout terminal and EMW bulb. ● Is resistance of both circuits less than 5 ohms?	YES ▶	REPLACE bulb. RECONNECT EMW sensor. REPEAT EM1.
	NO ▶	SERVICE open circuit. RECONNECT EMW sensor and REPEAT EM1.
EM5 CHECK VOUT FOR SHORTS TO GROUND OR POWER		
● Key Off. ● Disconnect EMW sensor. ● Disconnect EMW bulb ● DVOM on 200,000 ohm scale. ● Measure resistance between vout and battery negative terminal and between vout and battery positive. ● Is resistance greater than 10,000 ohms in both checks?	YES ▶	RECONNECT EMW sensor. RECONNECT EMW bulb. If light is always on in EM1, then GO to Table 2. If light is always off in EM1 then GO to Table 1.
	NO ▶	SERVICE short. Reconnect EMW module. Reconnect EMW bulb. REPEAT EM1.

Emission Maintenance Warning Light (EMW) EMW Light Never On

Table 1

SITUATION	ACTION TO TAKE
0 to 15,000 Miles	REPLACE module with 2000 hour "time out" module. No emission maintenance required.
15,000 to 45,000 Miles	REPLACE module with pretimed 1000 hour module. No emission maintenance required.
45,000 to75,000 Miles (no previous emission maintenance was done).	REPLACE module with 2000 hour "time out" module. Perform required emission maintenance.
60,000 to 75,000 Miles (previous emission maintenance has been done).	REPLACE module with 2000 hour "time out" module. No emission maintenance required.
75,000 to 105,000 Miles	REPLACE module with 1000 hour module. No emission maintenance required.
Greater than 105,000 Miles	REPLACE module with 2000 hour "time out" module. Perform required emission maintenance.

Emission Maintenance Warning Light (EMW) EMW Light Always On

Table 2

SITUATION	ACTION TO TAKE
0 to 15,000 Miles	RESET EMW module*. No emission maintenance required.
15,000 to 45,000 Miles	INSTALL new 1000 hour pre-timed EMW module. No emission maintenance required.
45,000 to 75,000 Miles (no previous emission maintenance was done).	RESET EMW module*. Perform emission maintenance.
60,000 to 75,000 miles (previous emission maintenance has been done).	RESET EMW module*. No emission maintenance required.
75,000 to 105,000 Miles	INSTALL new 1000 hour pre-timed EMW module. No emission maintenance required.
Greater than 105,000 Miles	RESET EMW module*. Perform emission maintenance.

***Refer to Table 3 for reset procedure, if not a resetable type module, replace with 2000 hour "time out" EMW module. If any module cannot be reset as described in Table 3, replace with a 2000 "time out" EMW module.**

Emission Maintenance Warning Light (EMW) Reset Procedure

Table 3

RESET PROCEDURE FOR EMW MODULE

The timer may be reset either before or after the timeout period has been exceeded. The procedure is the same for either condition.

Step 1

Turn the keyswitch to the Off position.

Step 2

Lightly push a phillips screwdriver through the .2 inch diameter hole with the sticker labeled 'RESET' and lightly press down and hold. Go to Step 3.

Step 3

Still pressing the screwdriver down, turn the keyswitch to the RUN position. The EMW lamp will then light and should remain lighted for as long as the screwdriver is pressed down. Hold the screwdriver down for approximately five seconds. Go to Step 4.

Step 4

Remove the screwdriver. The lamp should go out within approximately 2 to 5 seconds indicating a reset has occurred. (If the lamp does not go out then begin again with Step 1). Turn the keyswitch to the Off position and go to Step 5.

Step 5

Turn the keyswitch to the RUN position. The EMW lamp will light for approximately 2 to 5 seconds and will then go out. This verifies that a proper reset of the module has been accomplished. If the lamp remains on then the proper reset has not occured and the reset procedure should be repeated. Turn the keyswitch to the Off position.

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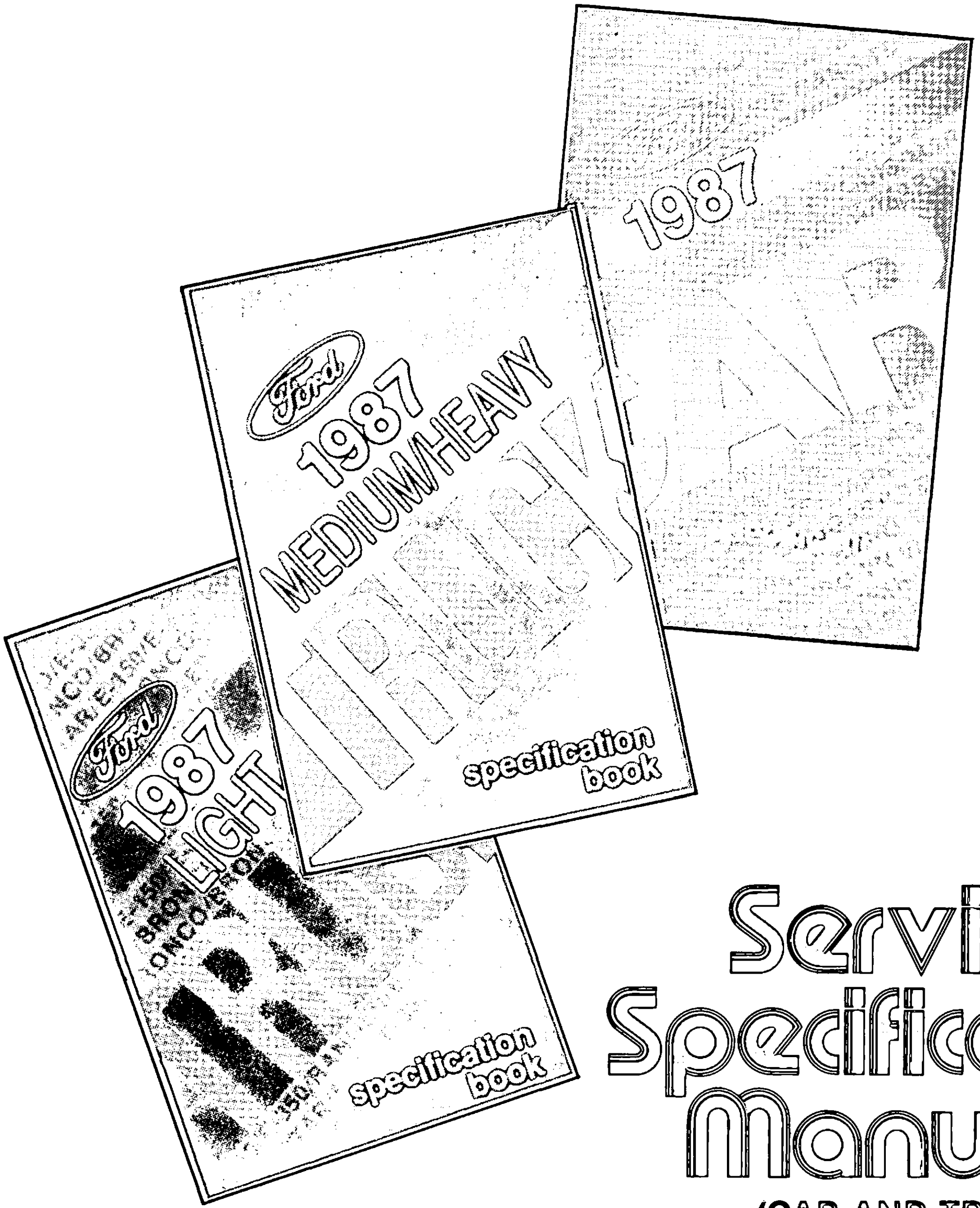

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SECTION 14

Idle Speed Control (Electrical Type, Non-EEC) — 2.0L 2V

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Why Are We Checking Out The ISC-E System?

The Idle Speed Control-Electronic (ISC-E) System has received a check-out before being released from the factory. Unless there has been mishandling or an accident, the chances are something else could be at fault.

Taking a few minutes at this point could save time and money later.

Be sure the owner has clearly explained the driving conditions that brought the owner in. Refer to the Diagnostic Routine Index, Section 2, for clues and corrections to the problems that may be encountered.

A fouled spark plug, disconnected vacuum hose, broken wire, a bad electrical wire crimp, wrong routing of hoses because someone else worked on the vehicle — any of these conditons can give a wrong reading on the ISC-E Quick Test. It is possible you may replace an ISC-E component and still not fix the problem.

**SO STOP...THINK...AND CHECK
BEFORE STARTING ON THE ISC-E SYSTEM!**

ISC-E System Description

The purpose of the Idle Speed Control-Electronic (ISC-E) System used on the 2.0L Ranger is to control engine rpm **only** by means of a DC motor throttle actuator. It **does not** control any other engine function such as air/fuel ratio, spark advance, exhaust gas recirculation, etc.

NOTE: The 1987 model year 2.0L Ranger uses an Aisan model Y 2V carburetor and Aisan DC motor idle speed control unit. Prior to the 1987 model year, the 2.0L Ranger used a Carter YFA 1V carburetor. Refer to Section 4 for the Aisan carburetor adjustment procedure.

How To Use The Diagnostic Procedure

DESCRIPTION

NOTE: Use this procedure only when the idle speed is too high, too low, or erratic.

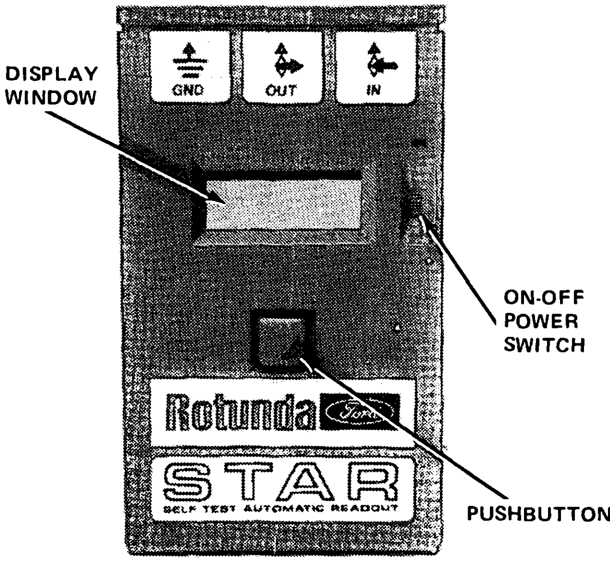
The Idle Speed Control-Electronic (ISC-E) System has the capability to diagnose a malfunction within its own system. It advises the technician where to look for ISC-E problems through the use of a Self-Test computer program built into the ISC-E module. When triggered, the Self-Test simulates a variety of engine operating conditions, so that operating conditions can be detected.

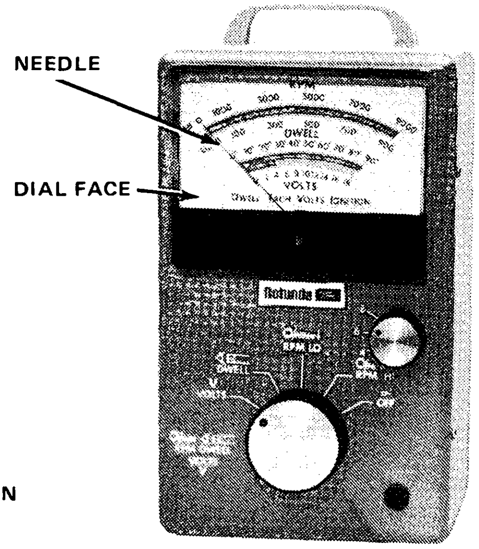
A received response to the initiated Self-Test is reported to the technician as a pulsing series of voltage outputs that will appear on one of two testing devices: an Analog Voltmeter or Self-Test Automatic Readout (STAR) tester, Rotunda model 007-00017.

The series of voltage pulses are called a Service Code, representing a two-digit number. It's the two-digit Service Code that advises the technician of the nature of the ISC-E problem. Hooking up the Analog Voltmeter or STAR tester to the ISC-E System will be described and shown later.

After performing the "Self-Test", the technician must follow all diagnostic procedures in the Engine/Emissions Diagnosis Manual prior to replacing any components. This will help assure service reliability.

NOTE: The ISC-E System uses only a Key On, Engine Running Quick Test, (No Key-On, Engine-Off Quick Test).


SELF-TEST AUTOMATIC READOUT (STAR) TESTER


ANALOG VOLTMETER

Quick Test Description

The Quick Test is a functional test of the Idle Speed Control-Electronic system consisting of basic Test Steps (described below). These Steps must be carefully followed in sequence, otherwise replacement of non-faulty components may result.

Test Steps

1. Visual Checks and Vehicle Preparation
   - Checks for obvious faults.
   - Properly prepares the vehicle for testing.
2. Equipment Hook-up
   - Ensures that the proper equipment for gathering test data is ready, prior to testing.
3. Unlike the EEC-IV system, Idle Speed Control-Electronic System uses only key-on, engine running self-test.
   - It is a dynamic check with the engine in operation.

The Engine Running Self-Test is intended to detect hard faults only, **not intermittent faults.**

Service Code Format

Engine Running Test

- Fast Codes
- Service Codes

WARNING: Anyone who departs from the instruction provided in this publication must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

Quick Test

ISC-E

1.0 VISUAL CHECK AND VEHICLE PREPARATION

Correct test results for the Quick Test are dependent on the proper operation of the ISC-E components. It may be necessary to correct faults to the components before ISC-E will pass Quick Test. Refer to Diagnostic Routines, Section 2 for additional service.

Before hooking up any equipment to diagnose the ISC-E system, make the following checks:

1. Verify the condition of air cleaner and ducting.
2. Check all engine vacuum hoses for:
   - Leaks or pinched hoses.
   - Proper emission routing per Vehicle Emission Control Information (VECI) Decal.
3. Check the ISC-E system components for wiring harness electrical connections for:
   - Proper connections.
   - Loose or detached connectors, wires and terminals.
   - Corrosion.
   - Proper routing of harness.

It may be necessary to disconnect the connector assembly to perform some of the inspections.

4. Perform all safety steps required to start and run operational vehicle tests.
5. Apply the emergency brake. Place shift lever in Park; Neutral for manual transmission.
6. Verify engine coolant is at the specified level.
7. Start engine and idle until the upper radiator hose is hot and pressurized and the throttle is off fast idle.

7A. **If the vehicle is a No Start, Go to Diagnostic Routines, Section 2.**

8. Turn ignition key Off. Proceed to Step 2.0 of Quick Test.

Quick Test

ISC-E

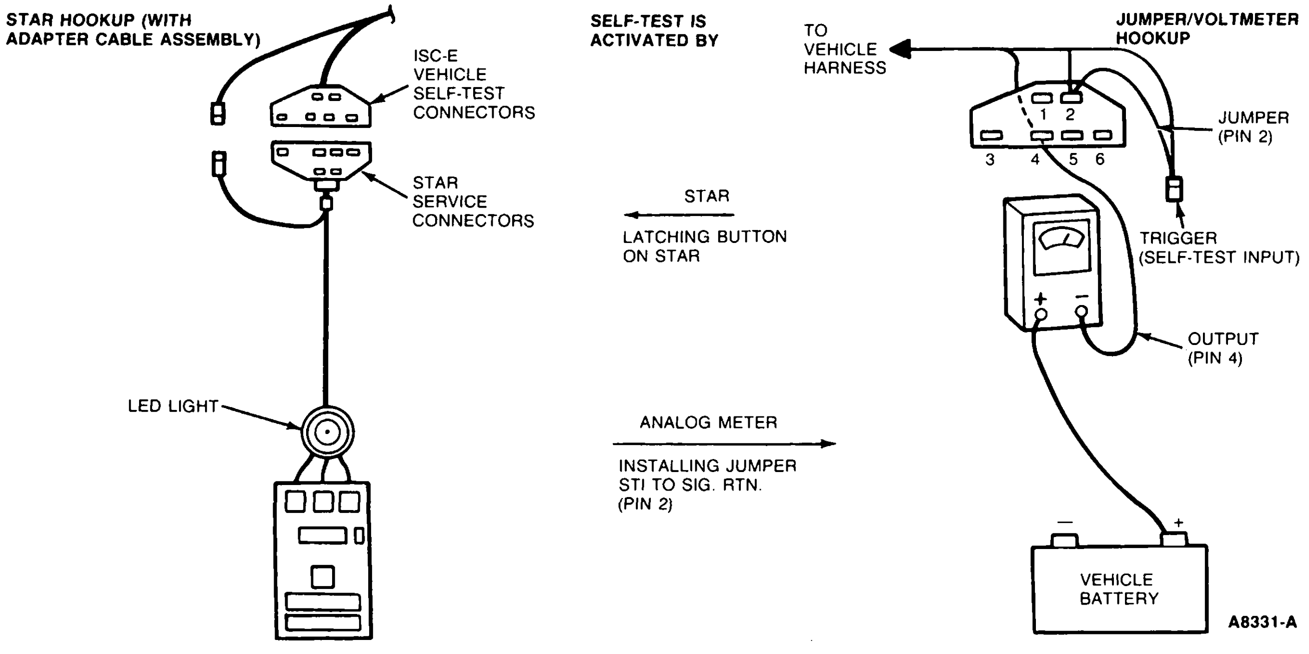
2.0 EQUIPMENT HOOKUP

Using the STAR tester:

- Turn ignition key Off.
- Connect the color-coded adapter cable leads to the STAR tester.
- Connect the adapter cable's two service connectors to the vehicle's appropriate Self-Test connectors.
- After vehicle hookup, Go to Quick Test Step 3.0.

Using analog voltmeter:

- Turn ignition key Off.
- Connect a jumper wire from Self-Test Input (STI) to Pin 2, Signal Return on the Self-Test connector (refer to the diagram below).
- Set analog VOM on a DC voltage range to read from 0 to 15 volts DC. Connect VOM from battery (+) to Pin 4 Self-Test Output (STO) in the Self-Test connector.
- After vehicle hookup, Go to Quick Test Step 3.0.



NOTE: ISC-E equipped vehicles do not contain the EEC-IV system. However ISC-E vehicles will utilize the same Self-Test connector.

Quick Test

ISC-E

3.0 ENGINE RUNNING QUICK TEST

- Start and run engine to stable idle. (Upper hose hot and pressurized.)
- Carburetor should be off high cam.
- Activate self-test.

Read codes.

—The system test will be performed (8-11 seconds)
—Engine running service codes.

- Observe and record all service codes. One of the following outputs will occur:

RESULT SERVICE CODE		ACTION TO TAKE
11	▶	GO TO PINPOINT TEST STEP SA1 .
58	▶	GO TO PINPOINT TEST STEP SA10 .
68	▶	GO TO PINPOINT TEST STEP SA20 .
12	▶	GO TO PINPOINT TEST STEP SA30 .
13	▶	GO TO SECTION 4 OF THIS MANUAL FOR ADJUSTMENT OF THE "KILL SPEED IDLE SCREW".
NO CODES	▶	GO TO PINPOINT TEST STEP SA40 .

Test Equipment

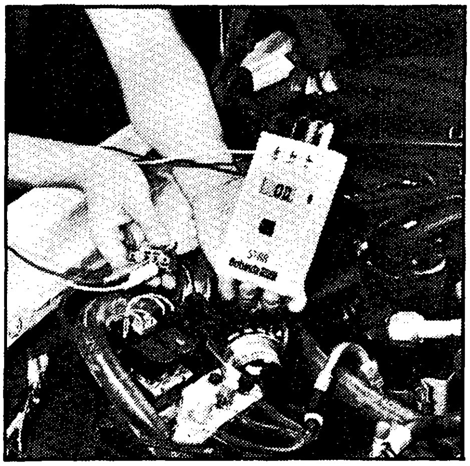
TEST EQUIPMENT REQUIRED FOR THE QUICK TEST:

ANALOG VOLTMETER

- Voltage Scale 0 to 20 Volts DC.

ROTUNDA SELF-TEST AUTOMATIC READOUT (STAR)

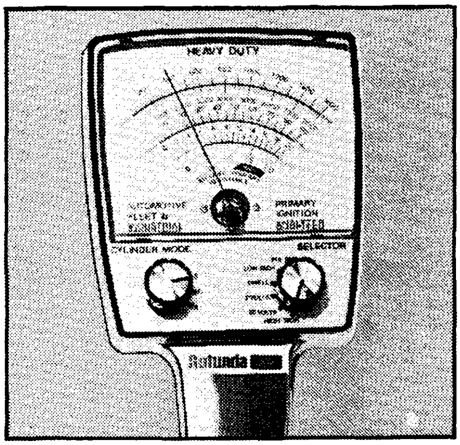
- No. 007-00017 or equivalent.
- Optional equipment used in place of Analog Voltmeter.



JUMPER WIRE

TACHOMETER

- Range of 0-3,000 rpm, Accuracy of ± 40 rpm, Resolution of 20 rpm.



Service Code Format

SERVICE CODES

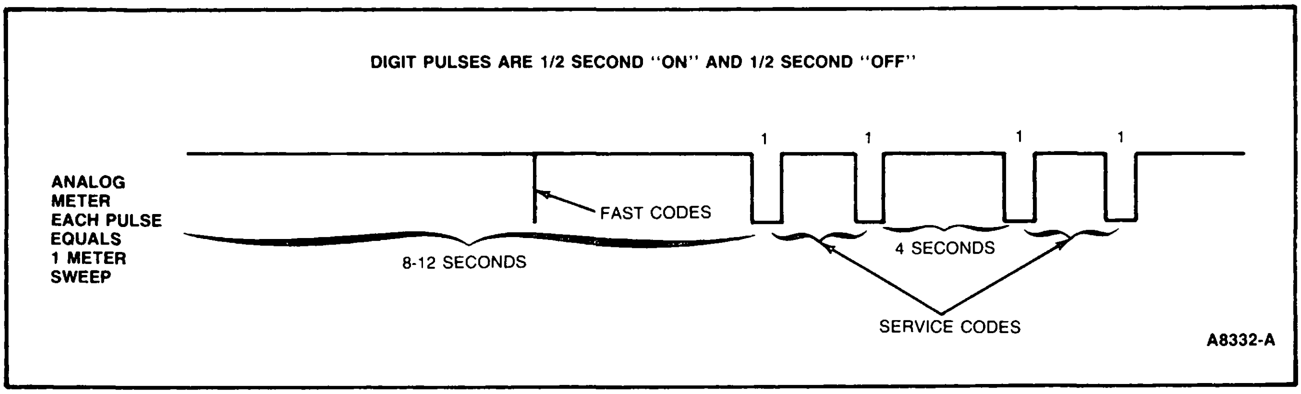
The ISC-E system communicates service information to the outside world by way of the Self-Test service codes. These service codes are two-digit numbers representing the results of Self-Test.

The service codes are transmitted on the Self-Test output (found in the Self-Test connector) in the form of timed pulses, and read by the technician on voltmeter or on the STAR tester.

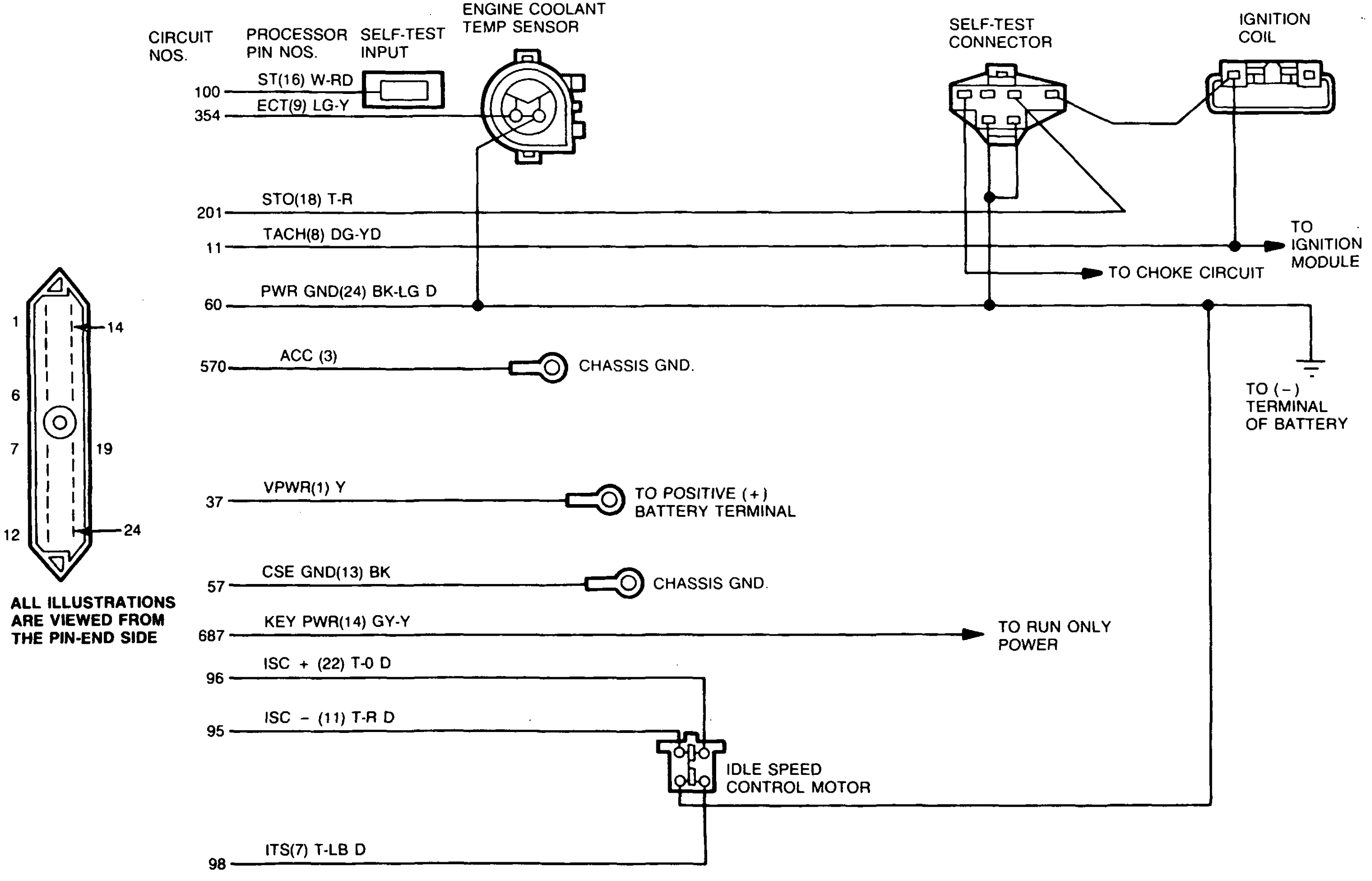
The pulse format is shown below:

- **One-half second on-time for each digit.**
- **Two seconds off-time between digits.**
- **Four seconds off-time between codes.**
- **Eight to twelve seconds before fast and service codes.**

SELF-TEST OUTPUT CODE FORMAT ENGINE RUNNING


DIGIT PULSES ARE 1/2 SECOND "ON" AND 1/2 SECOND "OFF"
ANALOG METER EACH PULSE EQUALS 1 METER SWEEP
1
1
1
1
FAST CODES
8-12 SECONDS
4 SECONDS
SERVICE CODES
A8332-A

ISC-E System Electrical Schematic



ALL ILLUSTRATIONS ARE VIEWED FROM THE PIN-END SIDE

Idle RPM Check

Pinpoint Test

SA

TEST STEP	RESULT ▶	ACTION TO TAKE
SA1 RPM CHECK		
⊙ Turn key Off. Disconnect Self-Test jumper or unlatch Star Tester. ⊙ Connect tachometer. ⊙ Start engine. ⊙ Read engine rpm. ⊙ Engine rpm should be 775 to 825 rpm.	Yes ▶ No ▶	GO to **SA2**. GO to **SA3**.
SA2 RPM CHECK		
⊙ Turn Off engine. ⊙ Disconnect engine coolant temperature switch. ⊙ Start engine. Engine rpm should be 1175 to 1225 rpm.	Yes ▶ No ▶	ISC-E system is functioning properly. GO to Pinpoint Test **SB**. GO to **SA3**.

Engine Coolant Temperature Switch

Pinpoint Test

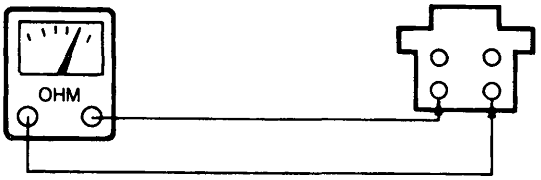
SA

TEST STEP		RESULT ▶	ACTION TO TAKE
SA3	ENGINE PREPARATION		
	• Run vehicle for two minutes at 2000 rpm. • Verify water temperature was above 128° during Self-Test (upper radiator hose hot and pressurized).	Yes ▶ No ▶	GO to **SA4**. GO to Diagnostic Routines, Section 2.
SA4	ECT SWITCH CHECK		
	• Disconnect the vehicle harness from the ECT switch. • Check contacts of Engine Coolant Temperature switch; should be closed above 128°. Measure resistance.	Resistance 5 ohms or less. ▶ Resistance more than 5 ohms. ▶	GO to **SA5**. REPLACE engine temperature switch. RETEST.
SA5	CONTINUITY CHECK		
	• Disconnect the vehicle harness from the ISC-E processor. • Check circuits 354 and 60 for continuity. Measure resistance.	Resistance 5 ohms or less. ▶ Resistance more than 5 ohms. ▶	GO to **SA6**. SERVICE or REPLACE circuit. RETEST.
SA6	SHORT TO GROUND		
	• Connect one lead of VOM to circuit 354 and the other lead to engine ground. • Measure resistance.	Resistance is more than 1,000 ohms. ▶ Resistance is 1,000 ohms or less. ▶	REPLACE ISC-E processor. RETEST. REPAIR or REPLACE circuit. RETEST.

Idle Tracking Switch Operation

Pinpoint Test

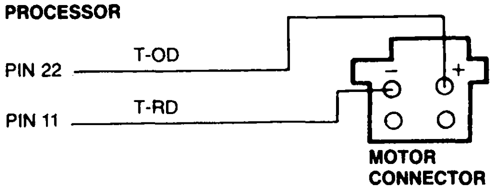
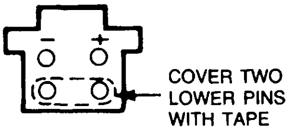
SA

TEST STEP	RESULT ▶	ACTION TO TAKE
SA10 SERVICE CODE 58		
● Turn key Off. ● Disconnect processor. ● Place VOM on 200 ohm scale. ● Measure resistance of ITS between processor connector Pin 7 and processor connector Pin 24. ● Move throttle lever from DC motor shaft to WOT. ● Resistance reading should be less than 5 ohms. ● Release the throttle lever to contact the DC motor shaft. If throttle does not contact shaft, depress shaft. Resistance reading should be greater than 5 ohms. ● Are resistance readings correct?	Yes ▶ No ▶	GO to **SA12**. GO to **SA11**.
SA11 ITS CHECK		
● Key Off. ● VOM on 200 ohm scale. ● Disconnect DC motor connector. ● Measure resistance of ITS from DC motor connector.  ● Lift and release throttle lever. ● Resistance reading should be less than 5 ohms with the throttle lever lifted. ● Resistance reading should be greater than 5 ohms with the throttle contacting the DC motor shaft. If throttle does not contact shaft, depress shaft.	Yes ▶ No ▶	SERVICE open in harness from DC motor connector to processor connector. REPEAT Quick Test. REPLACE DC motor. REPEAT Quick Test.

Idle Tracking Switch Operation

Pinpoint Test

SA

TEST STEP	RESULT ▶	ACTION TO TAKE
SA12 DC MOTOR MOVEMENT • Reconnect processor. • Start vehicle and perform Quick Test. • Check for motion of DC motor shaft during Quick Test. • Does motor shaft move during Quick Test?	Yes ▶	REPLACE processor. REPEAT Quick Test.
	No ▶	GO to SA13.
SA13 CONTINUITY CHECK • Disconnect processor. • Place VOM on 200 ohm scale. • Measure continuity of vehicle harness Pin 22 and Pin 11 from motor connector to processor connector.  PROCESSOR PIN 22 T-OD PIN 11 T-RD − + MOTOR CONNECTOR • Is resistance less than 5 ohms for each Pin?	Yes ▶	GO to SA14.
	No ▶	SERVICE harness. REPEAT Quick Test.
SA14 MOTOR MOVEMENT • Key Off. • Disconnect DC motor connector. Jumper positive battery terminal to positive lead at DC motor and negative terminal to negative lead at DC motor. **CAUTION: Battery voltage must not be applied to the ITS terminals. Isolate the ITS terminals with electrical tape during this test.**  • Apply voltage across the two upper pins and observe motor shaft movement. • Reverse polarity across the two upper pins and observe motor shaft reverse movement. • Does motor shaft move in both directions?	Yes ▶	REPLACE processor. REPEAT Quick Test.
	No ▶	REPLACE DC motor. REPEAT Quick Test.

Idle Tracking Switch

Pinpoint Test

SA

TEST STEP	RESULT ▶	ACTION TO TAKE
SA20 SERVICE CODE 68		
o Disconnect ISC-E processor connector. o Place VOM on 200 ohm scale. o Measure resistance at processor connector between Pin 7 and Pin 24 with throttle open. Resistance should be less than 5 ohms and greater than 5 ohms when the ISC motor shaft is depressed.	Yes ▶ No ▶	GO to **SA22**. GO to **SA21**.
SA21 ITS OPERATION		
o Disconnect ISC motor from harness. o Place VOM on 200 ohm scale. o Measure resistance at ISC motor connector (yellow and purple wires) with throttle held open. Resistance should be less than 5 ohms and change to greater than 5 ohms when the ISC motor shaft is depressed.	Yes ▶ No ▶	SERVICE harness. REPEAT Quick Test. REPLACE motor. REPEAT Quick Test.
SA22 MECHANICAL IDLE ADJUSTMENT		
o Perform mechanical idle speed adjustment, refer to Section 4. o Return to this Step after adjustment. o RERUN Quick Test.	Code 68 ▶ Code 11 ▶	REPLACE ISC-E processor. RERUN Quick Test. System OK.

RPM Out Of Range

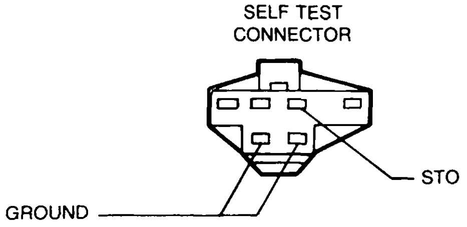
Pinpoint Test SA

TEST STEP	RESULT ▶	ACTION TO TAKE
SA30 VERIFY DC MOTOR MOVEMENT		
Service Code 12 • Bring vehicle to operating temperature. • Initialize Self-Test. • Visually verify DC motor movement during Self-Test.	Yes ▶	GO to SA13.
	No ▶	REFER to idle set adjustment, Section 4.

No Codes

Pinpoint Test

SA

TEST STEP	RESULT ▶	ACTION TO TAKE
SA40 CONTINUITY CHECK (POWER) (STI) o Disconnect positive battery cable. o Disconnect ISC-E processor. o Place VOM on 200 ohm scale. o Measure resistance between processor connector Pin 16 and Self-Test Input (STI) connector. Resistance should be less than 5 ohms.	Yes ▶ No ▶	GO to **SA41**. SERVICE harness. RERUN Quick Test.
SA41 CONTINUITY CHECK (STO) o VOM on 200 ohm scale. o Measure resistance between processor connector Pin 18 and Self-Test Output (STO) connector. Resistance should be less than 5 ohms.  	Yes ▶ No ▶	GO to **SA42**. SERVICE harness. RERUN Quick Test.
SA42 CONTINUITY CHECK (GROUND) o VOM on 200 ohm scale. o Measure resistance between battery cable negative and Self-Test connector ground terminals. Resistance should be less than 5 ohms.	Yes ▶ No ▶	GO to **SA43**. SERVICE harness. RERUN Quick Test.
SA43 CONTINUITY CHECK (GROUND) o Measure resistance between battery cable negative and processor connector Pin 24. Resistance should be less than 5 ohms.	Yes ▶ No ▶	GO to **SA44**. SERVICE harness. RERUN Quick Test.

No Codes

Pinpoint Test

SA

TEST STEP	RESULT ▶	ACTION TO TAKE
SA44 CONTINUITY CHECK (POWER)		
• VOM 200 OHM scale. • Measure resistance between battery cable positive to processor connector Pin 1. Resistance should be less than 5 ohms.	Yes ▶	GO to **SA45**.
	No ▶	SERVICE harness. RERUN Quick Test.
SA45 CONTINUITY CHECK (IGNITION RUN)		
• VOM on 200 ohm scale. • Measure resistance from processor connector Pin 14 to ignition run Circuit 687. Resistance should be less than 5 ohms.	Yes ▶	REPLACE ISC-E processor. RERUN Quick Test.
	No ▶	SERVICE harness. RERUN Quick Test.

Diagnostics By Symptoms

Pinpoint Test

SB

TEST STEP	RESULT ▶	ACTION TO TAKE
You should only use this Diagnostic by Symptom procedure if the drive complaint is high rpm at idle, low rpm at idle or erratic engine speeds. **This system does not control air/fuel ratio, spark advance, exhaust gas recirculation, etc.** Perform Self-Test, repair all service codes per Pinpoint Test. If drive complaint is still present, go to Diagnostic by Symptom and Diagnostic Routines, Section [2].		
SB1 HIGH OR LOW RPM AT IDLE		
○ Abnormal high or low rpm at idle.	▶	• Check vacuum routing per VECI decal. • REFER to Idle Speed Setting Procedure, Section [4].
SB2 IDLE FLUCTUATIONS:		
NOTE: Minor idle fluctuations are NORMAL due to load changes.	▶	• REFER to Idle Speed Setting Procedures, Section [4].

OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS

ORDERING INFORMATION
A special order form is included in the back of this manual for your convenience if you desire to order.

ENGINE EMISSIONS FACTS BOOK

- The manual contains complete specifications for each calibration number.
- Published at the conclusion of the model year.

ELECTRICAL & VACUUM TROUBLESHOOTING MANUAL (EVTM)

- Available for all passenger car and light truck vehicles, this publication provides schematics of all electrical and vacuum circuits. Wiring diagrams show how the circuit is powered. Troubleshooting hints are provided to point the technician in a general direction but are not step by step procedures.
- Available in the first quarter of the model year. (One manual for each passenger car and light truck family.)

WIRING & VACUUM DIAGRAMS

- This publication contains wiring diagrams for all Ford and Lincoln/Mercury passenger car and light truck vehicles. A Power Distribution system illustrates the power distribution throughout each vehicle. In addition, all individual electrical circuits are shown for each vehicle line.
- Available in the first quarter of the model year.

Service Specifications Manuals

(CAR AND TRUCK)

- These manuals contain all specifications including maintenance and lubrication contained in the Shop Manuals in a handy pocket size for easy reference.
- Available in the first quarter of the model year.

SECTION 15

Ignition Systems, Timing Procedures and Diagnostics

Contents

Initial Timing Procedure . . . 15-1

Spark Timing . . . 15-2

Symptom Index . . . 15-11

Ignition System Diagnostic Procedures . . . 15-11

- Part 1 (Secondary) . . . 15-12
- Part 2 (Primary)
  - Duraspark II . . . 15-20
  - TFI-IV . . . 15-38
- Part 3
  - Hall Effect Stator . . . 15-53

Intermittent Diagnosis Procedure . . . 15-58

PLEASE REFER TO TSB **89-5A** FOR: REVISED IGNITION COIL AND SECONDARY WIRE TEST STEP PROCEDURES AND ILLUSTRATION.

Initial Timing Procedure

PRELIMINARY NOTE

The procedure described below for setting initial timing is to be used under normal circumstances. If problems are encountered setting initial timing using this procedure, the spark timing procedure that follows should be used to diagnose the problem.

Procedure	A	B
①Place transmission in Park or Neutral, A/C and heater in OFF position.	X	X
②Remove vacuum hoses from the distributor vacuum advance connection at the distributor and plug the hoses.	X	
③Connect an inductive timing light, Rotunda 059-00006 or equivalent.	X	X
④Connect a tachometer, Rotunda 059-00010 or equivalent.	X	
⑤Disconnect the single wire in-line spout connector or remove the shorting bar from the double wire spout connector.		X
⑥If the vehicle is equipped with a barometric pressure switch (-12A243-) disconnect it from the ignition module and place a jumper wire across the pins at the ignition module connector (yellow and black wires).	X	
⑦Start the engine and allow it to warm up to operating temperature.	X	X
⑧With engine at timing rpm if specified, check/adjust initial timing to specification.	X	X
⑨Reconnect single wire in-line spout connector or reinstall the shorting bar on the double wire spout connector. Check timing advance to verify distributor is advancing beyond the initial setting. If it is not, refer to Section 16 Quick Test 04.		X
⑩Remove test instruments.	X	X
⑪Unplug and reconnect vacuum hoses.	X	
⑫Remove jumper from ignition connector and reconnect if applicable.	X	

Procedure	Passenger Car	Light Truck	Medium/Heavy Truck
A	1.9L-2V 2.3L HSC-1V 3.8L-2V 5.8L-VV FBC	2.0L-2V 5.8L-4V 7.5L-4V	4.9L-1V 5.8L-4V 6.1L-2V/4V 7.0L-4V
B	1.9L CFI 1.9L EFI 2.3L OHC EFI 2.3L OHC EFI TC 2.3L HSC CFI 2.5L HSC CFI 3.0L EFI 3.8L CFI 5.0L SEFI 5.0L HO SEFI	2.3L OHC EFI 2.9L EFI 3.0L EFI 4.9L EFI 5.0L EFI 7.5L EFI	

NOTE: Spout connectors are normally located near the distributor. On 2.3L EFI Ranger, the spout connector is located between the engine and the RH fender apron.

CA7714-D

PLEASE REFER TO TSB 87-21-9 FOR NEW TFI DIAGNOSTIC PROCEDURES.

SPARK TIMING

Spark Timing

CHECKOUT

- Visually inspect the engine compartment to ensure all vacuum hoses and spark plug wires are properly routed and securely connected.
- Examine all wiring harnesses and connectors for insulation damage, burned, overheated, loose or broken conditions.
- Be certain battery is fully charged.
- All accessories should be Off during diagnosis.

EQUIPMENT

Obtain the following test equipment or an equivalent:

- Inductive Timing Light, Rotunda 059-00006.
- Tachometer, Rotunda 099-00003.
- Vacuum Gauge, Rotunda 059-00008.

NOTES

- This Procedure is not applicable to EEC-IV equipped vehicles.
- This Procedure checks the operation of the centrifugal and vacuum advance mechanisms in the distributor. It is also to be used to check the operation of the retard feature of the (-12A244-) Ignition Module.

Spark Timing

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
STEP 1 • Disconnect and plug distributor vacuum hose(s). • Connect timing light and tachometer.		• Go to Step 2.
STEP 2 • If Ignition Module with Basic Part No. (-12A244-) is used: • Disconnect two wire connector (YELLOW and BLACK wires) • Jumper pins in module connector • If (-12A244-) Ignition Module not used, skip this Step.		• Go to Step 3.
STEP 3 • Start and warm-up engine. • Check that engine speed is at or below timing rpm.*	Engine speed at or below timing rpm*	• OK. • Go to Step 4.
	Engine speed above timing rpm*	• Reset rpm below timing rpm. • Go to Step 4.

***Refer to Vehicle Emission Control Information Decal.**

Spark Timing

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
STEP 4		
• Positive-Buy timing?	Yes	• Go to Step 5.
	No	• Go to Step 6.
STEP 5		
• Check initial timing. **NOTE: Record reading for later use.**	Within ± 4 degrees of required*	• Go to Step 7.
	Not within ± 4 degrees of required*	• Reset timing. Remove or deface positive buy label. • Go to Step 7.
STEP 6		
• Check initial timing. **NOTE: Record reading for later use.**	Within ± 2 degrees of required	• Go to Step 7.
	Not within ± 2 degrees of required	• Reset timing. • Go to Step 7.

***Refer to Vehicle Emission Control Information Decal.**

Spark Timing

IGNITION MODULE (-12A244-), AND IGNITION BAROMETRIC PRESSURE SWITCH (-12A243-) TESTING

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
STEP 7 ○ Basic Part No. (-12A244-) on ignition module?	Yes	● Remove jumper in two wire connector. ● Reconnect two wire connector. ● Go to Step 8.
	No	● Go to Step 11.
STEP 8 ○ Check initial timing at timing rpm.	Timing same as Step 5 or Step 6	● Disconnect two wire connector, (YELLOW and BLACK wires) at ignition module. ● Go to Step 9.
	NOTE: Engine may die when connector is separated due to excessive spark retard. If this happens spark retard operation is OK. Reconnect two wire connector, Go to Step 11.	
	Timing not same as Step 5 or Step 6	● Refer to the MCU Diagnosis Manual then return to Step 2.
STEP 9 ○ Check initial timing at timing rpm.	Timing retarded from Step 8	● Retard operation OK. ● Remove vacuum gauge and reconnect vacuum hose (if used). ● Go to Step 11.
	Timing not retarded from Step 8	● Go to Step 10.

Spark Timing

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
STEP 10 • Substitute new ignition module. • Connect two wire (RED and WHITE wires) and four wire connectors. • Jumper pins in two wire (YELLOW and BLACK wires) connector. • Check initial timing at timing rpm.	Timing same as Step 5 or Step 6	• Return to Step 8. **NOTE: If ignition module substitution appears to correct problem, reconnect original module and repeat this Step to verify service.**
	Timing not same as Step 5 or Step 6	• Repeat to Step 10.

DISTRIBUTOR CENTRIFUGAL ADVANCE MECHANISM TESTING

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
STEP 11 • Increase engine speed to 2,500 rpm. • Check spark timing. • Return to idle rpm. NOTE: Refer to the Service Performance Manual for **total advance at 2,500 rpm/vacuum advance disconnected** under the correct engine calibration for specification.	Timing within specification	• Go to Step 12.
	Timing not within specification	• Replace distributor. • Repeat this Step.
STEP 12 • Check initial timing at timing rpm.	Timing same as Step 5 or Step 6	• Distributor mechanical advance mechanism OK. • Go to Step 13.
	Timing not same as Step 5 or Step 6	• Replace distributor. • Return to Step 11.

Spark Timing

DISTRIBUTOR VACUUM ADVANCE MECHANISM TESTING

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
STEP 13 • Install distributor vacuum **advance** hose without spark delay valve if used. • Increase engine speed to 2,500 rpm, hold for 60 seconds. • Check spark timing. • Return to idle rpm. NOTE: Refer to the Service Performance Manual for **total advance at 2,500 rpm/vacuum advance connected** under the correct engine calibration for specification.	Timing within specification	• Distributor vacuum advance mechanism OK. • Refer to Section 3. Check operation of spark-delay valve if used. • Go to Step 17.
	Timing not within specification	• Go to Step 14.
STEP 14 • Install vacuum gauge in vacuum advance hose, using Tee connector. • Increase engine speed to 2,500 rpm, hold for 60 seconds. • Check for presence of vacuum. • Return to idle rpm.	51 kPa (15 in-Hg) vacuum minimum	• Inspect diaphragm for vacuum leaks and stator assembly for sticking/binding. Service/replace as necessary. • Return to Step 13.
	Less than 51 kPa (15 in-Hg) vacuum	• Go to Step 15.

Spark Timing

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
STEP 15		
• Check engine for vacuum lockout devices. (Refer to Vehicle Emission Control Information Decal)	Has lockout devices	• Go to Step 16.
	No lockout devices	• Service vacuum source. • Return to Step 13.
STEP 16		
• Disconnect and plug distributor vacuum advance hose. • Attach vacuum hose between distributor vacuum advance diaphragm connection and manifold vacuum. • Increase engine speed to 2,500 rpm. • Check spark timing. • Return to idle rpm. NOTE: Refer to the Service Performance Manual for **total advance at 2,500 rpm/vacuum advance connected** under the correct engine calibration for specification.	Timing within specification	• Service vacuum source. • Disconnect manifold vacuum. • Remove vacuum gauge and Tee. • Return to Step 13.
	Timing not within specification	• Inspect diaphragm for leaks and stator assembly for sticking/binding. Service/replace as necessary. • Disconnect manifold vacuum. • Reconnect normal vacuum source. • Return to Step 13.

Spark Timing

DISTRIBUTOR VACUUM RETARD MECHANISM TESTING

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
STEP 17		
o Does distributor have dual diaphragm?	Yes	o Go to Step 18.
	No	o Spark timing systems OK.
STEP 18		
o Disconnect and plug vacuum hose to vacuum advance connection on diaphragm. o Connect vacuum hose to retard connection on diaphragm. o Check spark timing at idle rpm.	Timing retarded from Step 5 or Step 6	o Spark timing systems OK. o Reconnect vacuum hose to vacuum advance connection.
	Timing not retarded from Step 5 or Step 6	o Go to Step 19.
STEP 19		
o Install vacuum gauge in vacuum hose to retard connection on diaphragm. o Check for presence of vacuum at idle rpm.	51 kPa (15 in-Hg) vacuum minimum	o Replace distributor diaphragm assembly. o Return to Step 18.
	Less than 51 kPa (15 in-Hg) vacuum	o Service vacuum source. o Return to Step 18.

Diagnostic Procedures

PRELIMINARY NOTES

The engine analyzer is used to diagnose problems in the secondary side of the ignition system. This covered in Part 1, which is common for all ignition systems used in 1987.

For problems in the primary side of the ignition system, there is a separate Part 2 for each of the three basic types of ignition systems and a Part 3 for TFI-IV.

The beginning point for Ignition System Diagnosis is the Symptom Index. This will direct you to the proper part for your engine symptom.

If after completing a Part 1, Part 2 or Part 3 diagnosis and a problem has not been solved, the problem is either an intermittent one or is not in the ignition system. If you suspect it to be intermittent, refer to intermittent diagnosis. Otherwise return to the Diagnostic Routines, (Section 2), for additional assistance.

SYMPTOM INDEX

ENGINE SYMPTOM	START AT
• CRANKS NORMALLY BUT WON'T START	PART 2
• STARTS NORMALLY BUT WON'T RUN (STALLS)	PART 2
• CRANKS NORMALLY BUT SLOW TO START	PART 1
• ROUGH IDLE	PART 1
• ENGINE MISS	PART 1
• POOR FUEL ECONOMY	PART 1
• ROUGH IDLE OR ENGINE MISS AT COLD TEMPERATURE-OK WARM-EEC IV EQUIPPED VEHICLES ONLY	PART 1 IF NOT RESOLVED, PART 3

PART 1

Preliminary Checkout & Equipment

CHECKOUT

- Visually inspect the engine compartment to ensure all vacuum hoses and spark plug wires are properly routed and securely connected.
- Examine all wiring harnesses and connectors for insulation damage, burned, overheated, loose, or broken conditions.
- Be certain the battery is fully charged.
- All accessories should be Off during diagnosis.

EQUIPMENT

Obtain the following test equipment or an equivalent:

- Spark Tester, Special Service Tool D81P-6666-A. See note.
- Engine Analyzer, Rotunda 002-00373.
- Digital Volt-Ohmmeter, Rotunda 014-00407.

NOTE

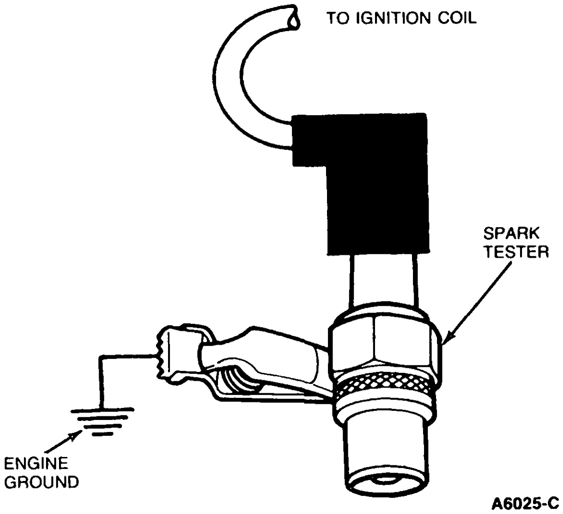
- A spark plug with a broken side electrode **is not** sufficient to check for spark and may lead to incorrect results.

Ignition Coil Secondary Voltage | Part 1 | Test 1

TEST EQUIPMENT: SPARK TESTER, VOM

TEST PROCEDURE

1. Connect spark tester between ignition coil wire and engine ground.
2. Crank engine.
3. Disconnect spark tester, reconnect coil wire to distributor cap.



TEST RESULT	TEST RESOLUTION
Spark	● Test Result OK. ● Go to Part 1, Test 2.
No Spark	● Inspect ignition coil for damage, carbon tracking. ● Measure resistance of ignition coil wire. Replace if greater than 7,000 ohms per foot. ● Go to: Part 2, Test 2

Secondary Display

Part 1

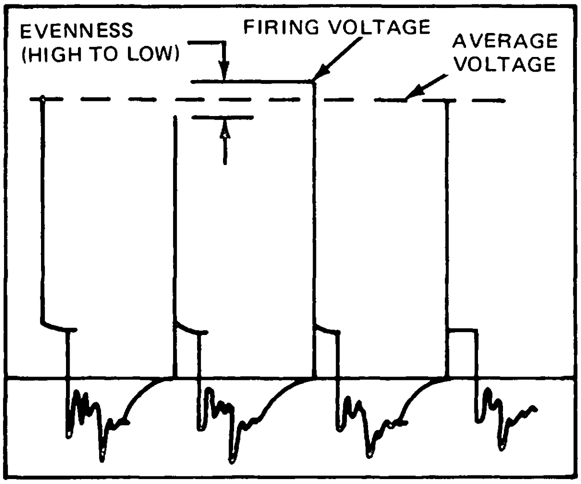
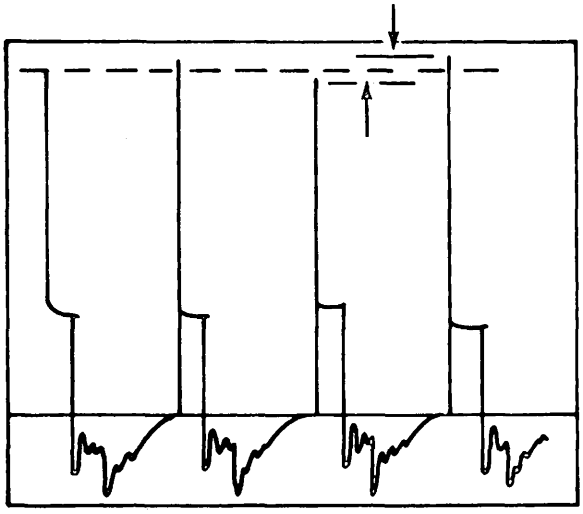
Test 2

TEST EQUIPMENT: ENGINE ANALYZER

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
NOTE: If this portion of the diagnostic procedure is to provide **accurate** results, it is **essential** that the calibration of your engine analyzer be maintained. Refer to your equipment manual. If this is not available, an **estimate** of the calibration can be made by connecting the spark tester (Special Service Tool, D81P-6666-A or equivalent) to a properly operating ignition system and measuring the firing voltage of the spark tester **only. Do not include the firing voltage of the rotor-to-cap gap.** The spark tester firing voltage should be **approximately** 28 KV.		
1. Connect engine analyzer to view **parade** display of ignition system secondary. 2. While **slowly** increasing engine rpm from idle to 2,000 rpm, compare engine analyzer display to the following illustrations. The illustrations shown are four cylinder but are typical for all engines. 3. Disconnect engine analyzer.		

Secondary Display (Continued) | Part 1 | Test 2

TEST EQUIPMENT: ENGINE ANALYZER

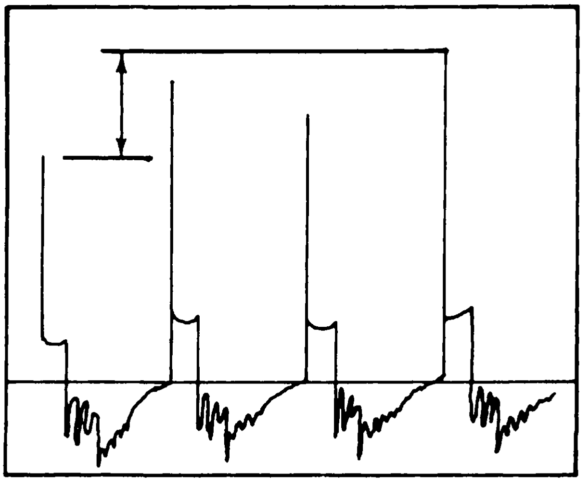
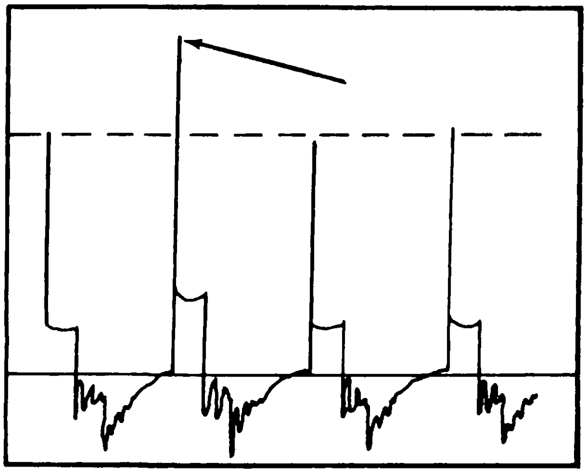
TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
 A6342-A	Evenness of spark plug firing voltage: 5 KV or less And the average value of spark plug firing voltage: 15 KV or less	- These are normal values for a properly operating ignition system.
 A6343-A	Evenness of spark plug firing voltage: 5 KV or less And the average value of spark plug firing voltage: greater than 15 KV	**Problems affecting all cylinders:** - Check ignition coil wire for proper installation in coil and distributor cap. - Measure resistance of ignition coil wire. Replace if greater than 7,000 ohms per foot. - Wide spark plug gaps — all cylinders, (usually from worn electrodes due to high mileage). - Inspect cap and rotor for problems causing excessive cap-to-rotor gap. - Inspect cap and rotor for lack of silicone compound. (Blade rotors only).

Secondary Display (Continued)

Part 1

Test 2

TEST EQUIPMENT: ENGINE ANALYZER

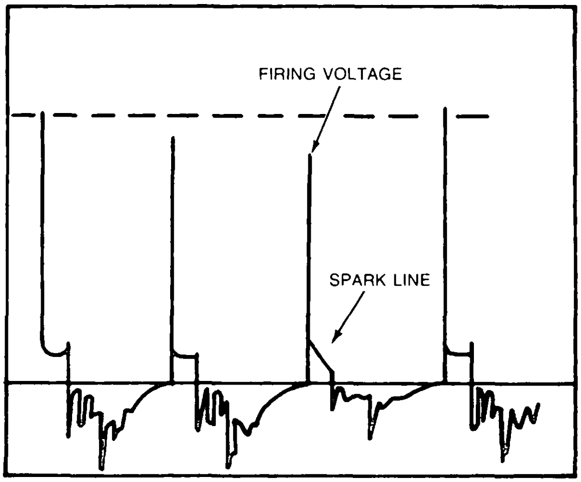
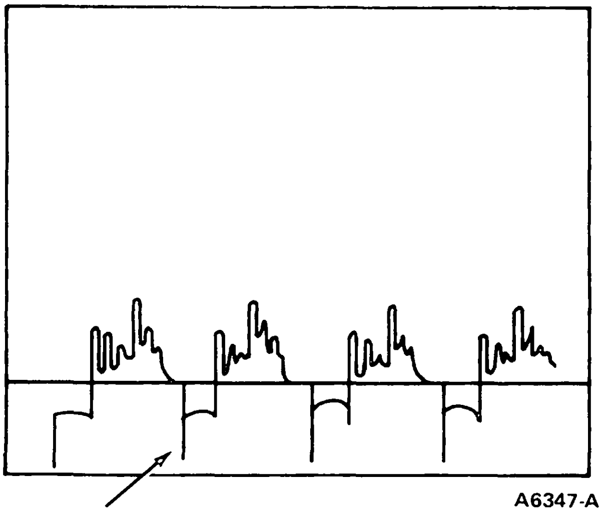
TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
 A6344-A	Evenness of spark plug firing voltage: greater than 5 KV	**Problems affecting some cylinders:** • Wide spark plug gap(s) or worn electrode(s). • Improperly installed cap, adapter, or rotor.
 A6345-A	Consistently high spark plug firing voltage in one or more cylinders	• Spark plug wire(s) not firmly connected to distributor cap or spark plug. • Disconnected spark plug wire(s). • Wide spark plug gap(s). • Open plug wire(s). Go to Part 1, Test 3.

Secondary Display (Continued)

Part 1

Test 2

TEST EQUIPMENT: ENGINE ANALYZER

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
 A6346-B	Consistently low spark plug firing voltage or sloping spark line in one or more cylinders	• Fouled spark plug(s). • Narrow spark plug gap(s). • Spark plug wire(s) grounding on engine. Inspect for damage. • Carbon tracking in cap and adapter.
 A6347-A	Spark plug firing voltage negative going.	Ignition coil primary circuit reversed. Check wiring harness for ignition coil primary circuit. If OK replace ignition coil.

Spark Plug Wire Resistance

Part 1

Test 3

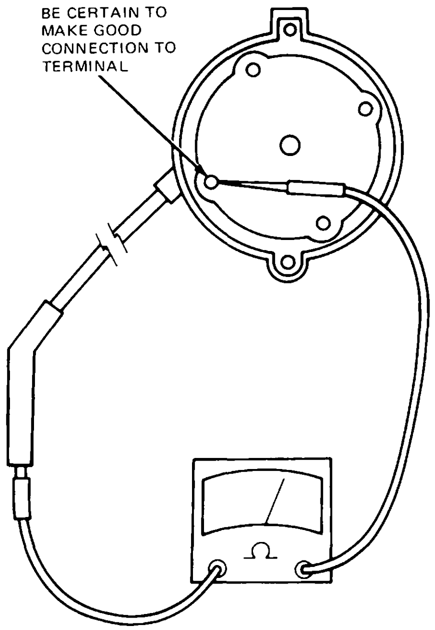
TEST EQUIPMENT: VOM

TEST PROCEDURE

1. Remove distributor cap from distributor.
2. Check for spark plug wires firmly seated on cap.
3. Disconnect spark plug end of suspect wire(s).
4. Measure resistance from terminal in cap to spark plug terminal.
5. Reinstall distributor cap and connect spark plug wire to spark plug.

CAUTION: Do not, under any circumstances, puncture a spark plug wire when measuring resistance. Measure only as instructed.

TEST RESULT	TEST RESOLUTION
Less than 7,000 ohms per foot	• Spark plug wire resistance OK.
Greater than 7,000 ohms per foot	• Replace spark plug wire(s).



A6166-B

PART 2
DURASPARK II IGNITION SYSTEM

Preliminary Checkout, Equipment & Notes

CHECKOUT

- Visually inspect the engine compartment to ensure all vacuum hoses and spark plug wires are properly routed and securely connected.
- Examine all wiring harnesses and connectors for insulation damage, burned, overheated, loose, or broken conditions.
- Be certain the battery is fully charged.
- All accessories should be Off during diagnosis.

EQUIPMENT

Obtain the following test equipment or an equivalent:

- Spark Tester, Special Service Tool D81P-6666-A. See note.
- Digital Volt-Ohmmeter Rotunda 014-00407.
- 12 Volt Test Light.
- Small straight pins (2).

NOTES

- A spark plug with a broken side electrode **is not** sufficient to check for spark and may lead to incorrect results.
- All wire colors referred to in this part relate to the colors of the ignition module wires. When working with a wiring harness, the wires must be traced back to the ignition module for proper color identification.
- When instructed to inspect a wiring harness, both a visual inspection and a continuity test should be performed.
- When making measurements on a wiring harness or connector, it is good practice to wiggle the wires while measuring.

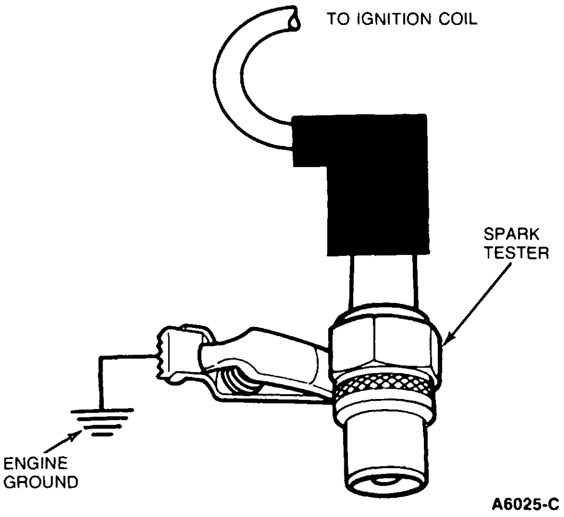
Start Circuits

DS II

Part 2 Test 1

TEST EQUIPMENT: SPARK TESTER, VOM

TEST PROCEDURE
1. Connect spark tester between ignition coil wire and engine ground. 2. Crank engine using ignition switch.



TEST RESULT	TEST RESOLUTION
Sparks	● Go to Part 2, Test 2.
No Sparks	● Measure resistance of ignition coil wire. Replace if greater than 7,000 ohms per foot. ● Inspect ignition coil for damage, carbon tracking. ● Crank engine to verify distributor rotation. Refer to Shop Manual, Group 23 and service as required. ● Go to Part 2, Test 5.

Run Circuits

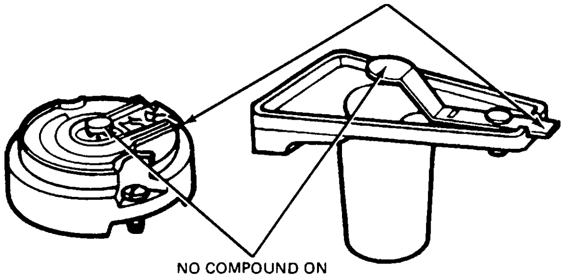
DS II

Part 2
Test 2

TEST EQUIPMENT: SPARK TESTER, VOM

TEST PROCEDURE

1. Turn ignition switch from Off to Run to Off position several times.
2. Spark should occur each time switch goes from Run to Off position.
3. Remove spark tester, reconnect coil wire to distributor cap.


COAT COMPLETE SURFACE OF ROTOR BLADE TIP WITH SILICONE COMPOUND — 1/32" THICK*
NO COMPOUND ON THIS SURFACE
ESCORT/LYNX, EXP
6- AND 8-CYLINDER APPLICABLE TO 4 CYLINDER

*DO NOT USE SILICONE COMPOUND ON MULTIPOINT ROTOR.

TEST RESULT	TEST RESOLUTION
Sparks	• Inspect distributor cap, adapter, rotor for cracks, carbon tracking, lack of silicone compound. • Check for roll pin securing armature to sleeve in distributor. • Check that ORANGE and PURPLE wires not crossed between distributor and ignition module. • If ignition module has Basic Part No. (-12A244-), Go to the Spark Timing section to check spark retard operation.
No Sparks	• Go to Part 2, Test 3.

Module Voltage

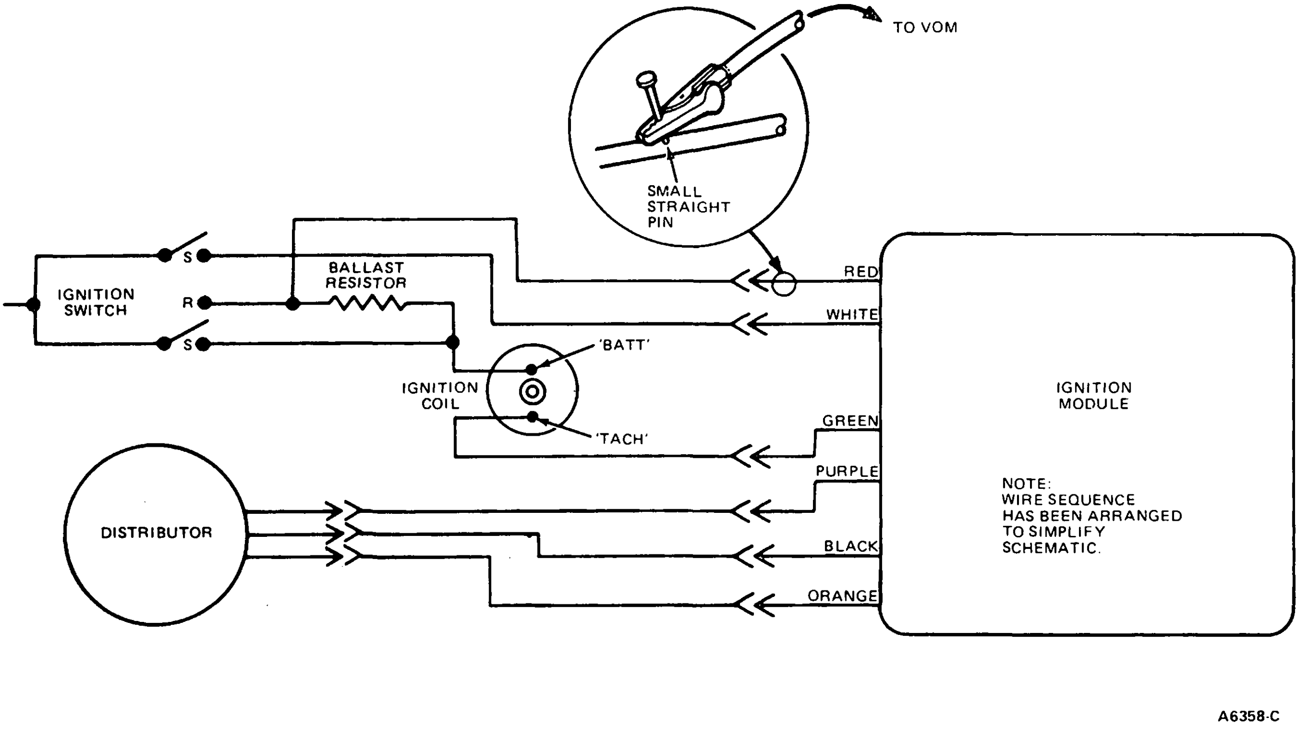
DS II

Part 2 Test 3

TEST EQUIPMENT: VOM, STRAIGHT PIN

TEST PROCEDURE
- Turn ignition switch Off. 1. Carefully insert small straight pin in RED module wire. **CAUTION: Do not allow straight pin to contact electrical ground.** 2. Attach negative (–) VOM lead to distributor base. 3. Measure battery voltage. 4. Measure voltage at straight pin with ignition switch in Run position. 5. Turn ignition switch to Off position. 6. Remove straight pin.

TEST RESULT	TEST RESOLUTION
90 percent of battery voltage or greater	○ Go to Part 2, Test 4.
Less than 90 percent of battery voltage	○ Refer to vehicle wiring diagram. Inspect wiring harness between module and ignition switch. ○ Worn or damaged ignition switch. Refer to Shop Manual, Group 33.



Ballast Resistor

DS II

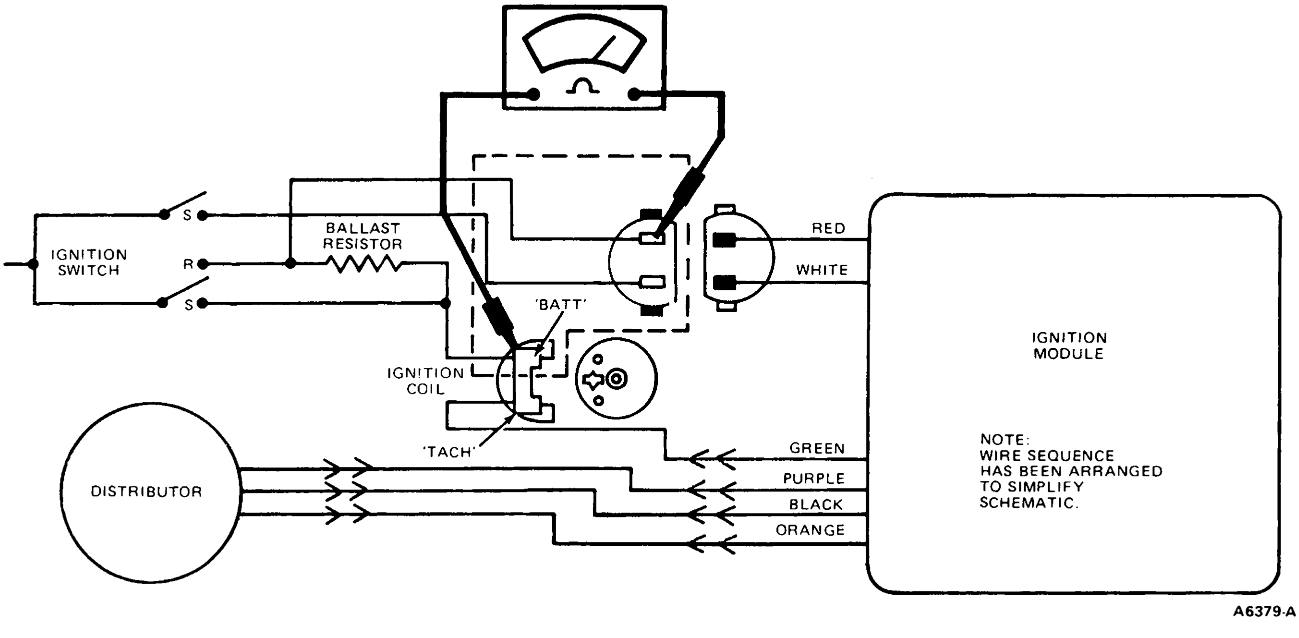
Part 2 Test 4

TEST EQUIPMENT: VOM

TEST PROCEDURE

1. Separate and inspect ignition module two wire connector with RED and WHITE wires.
2. Disconnect and inspect ignition coil connector.
3. Measure ballast resistor between BATT terminal of ignition coil connector and wiring harness connector mating with RED module wire.
4. Reconnect all connectors.

TEST RESULT	TEST RESOLUTION
0.8 to 1.6 ohms	• Problem is either intermittent or not in ignition system. • Refer to Intermittent Diagnosis or return to Section 2, Diagnostic Routines.
Less than 0.8 or greater than 1.6 ohms	• Replace ballast resistor.



NOTE: WIRE SEQUENCE HAS BEEN ARRANGED TO SIMPLIFY SCHEMATIC.

Supply Voltage Circuits

DS II

Part 2 Test 5

TEST EQUIPMENT: VOM, STRAIGHT PINS

TEST PROCEDURE

1. Remove SPARK TESTER, reconnect coil wire to distributor cap.
2. If starter relay has I terminal, disconnect cable from starter relay to starter motor.
3. If starter relay does not have I terminal, disconnect wire to S terminal of starter relay.
4. Carefully insert small straight pins in RED and WHITE module wires.

   CAUTION: Do not allow straight pins to contact electrical ground.

5. Measure battery voltage.
6. Following table below, measure voltage at points listed with ignition switch in position shown.

   NOTE
   - **Attach negative (−) VOM lead to distributor base.**
   - **Wiggle wires in wiring harness when measuring.**

WIRE/ TERMINAL	CIRCUIT	IGNITION SWITCH TEST POSITION
RED	RUN	RUN
WHITE	START	START
'BATT' TERMINAL IGNITION COIL	BALLAST RESISTOR BYPASS	START

7. Turn ignition switch to Off position.
8. Remove straight pins.
9. Reconnect any cables/wires removed from starter relay.

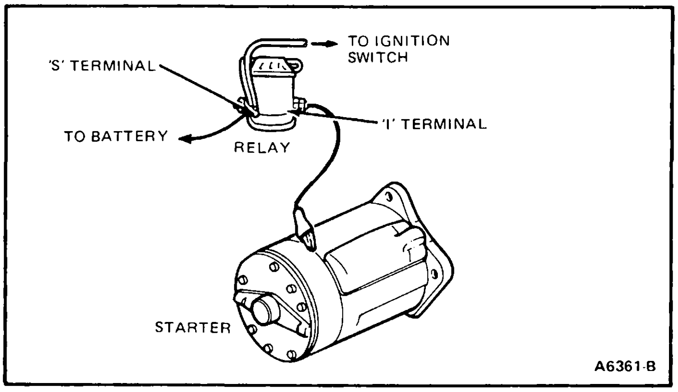
TEST RESULT	TEST RESOLUTION
90 percent of battery voltage or greater.	o Test result OK. o Go to Part 2, Test 6.
Less than 90 percent of battery voltage	o Refer to vehicle wiring diagram. Inspect wiring harness and connector(s) in faulty circuit(s). o Worn or damaged ignition switch: Refer to Shop Manual, Group 33. o Radio interference capacitor on ignition coil.

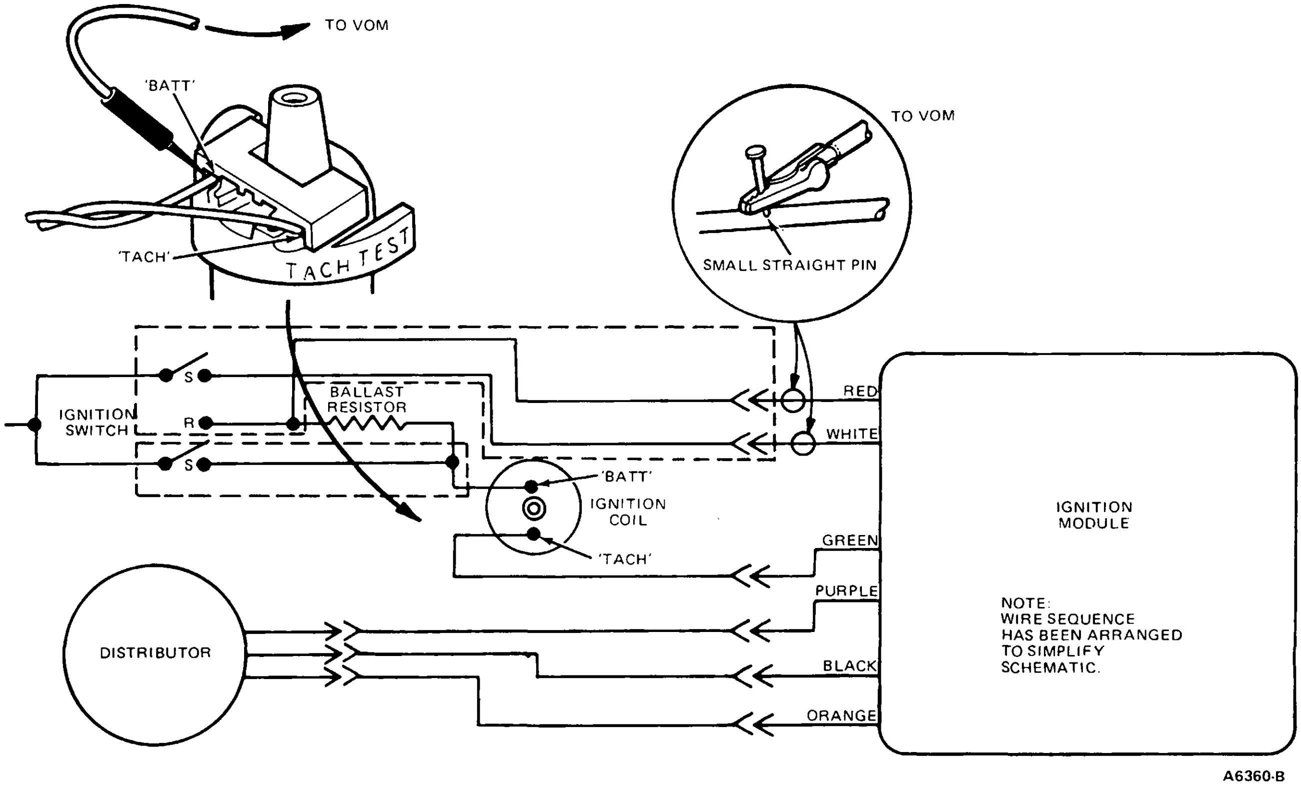
Supply Voltage Circuits (Continued)

DS II

Part 2 Test 5

TEST EQUIPMENT: VOM, STRAIGHT PINS





A6360-B

Ignition Coil Supply Voltage

DS II

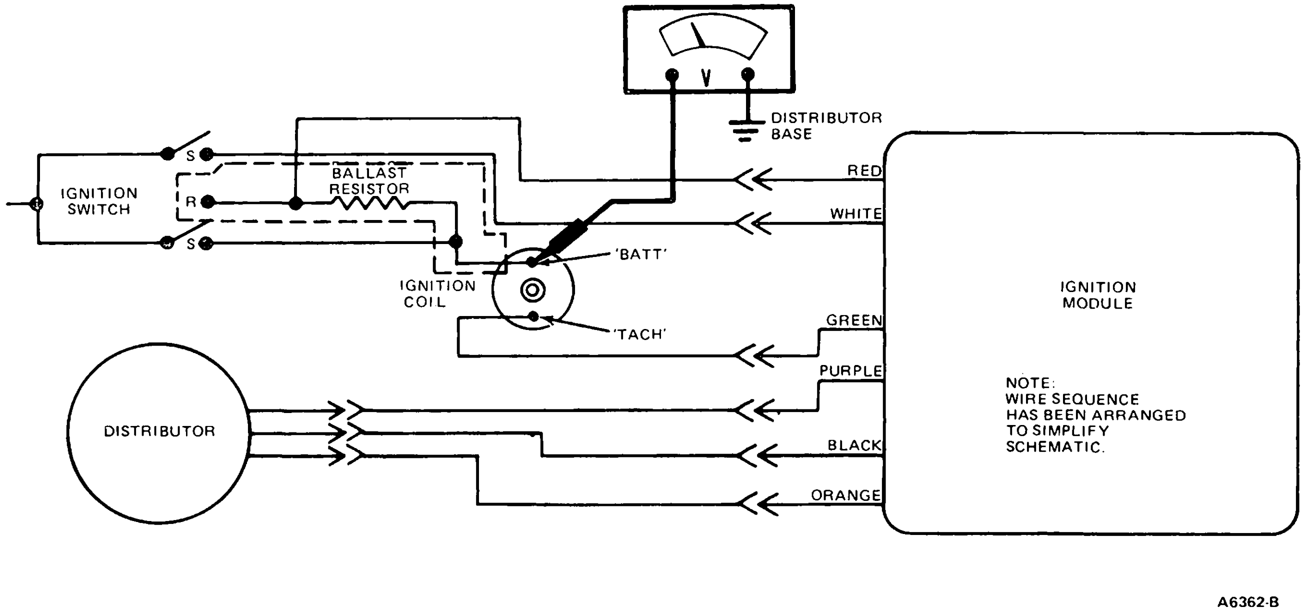
Part 2
Test 6

TEST EQUIPMENT: VOM

TEST PROCEDURE

1. Attach negative (−) lead of VOM to distributor base.
2. Turn ignition switch to Run position.
3. Measure voltage at BATT terminal of ignition coil.
4. Turn ignition switch to Off position.

TEST RESULT	TEST RESOLUTION
6 to 8 volts	• Go to Part 2, Test 7.
Less than 6 volts or greater than 8 volts	• Go to Part 2, Test 12.



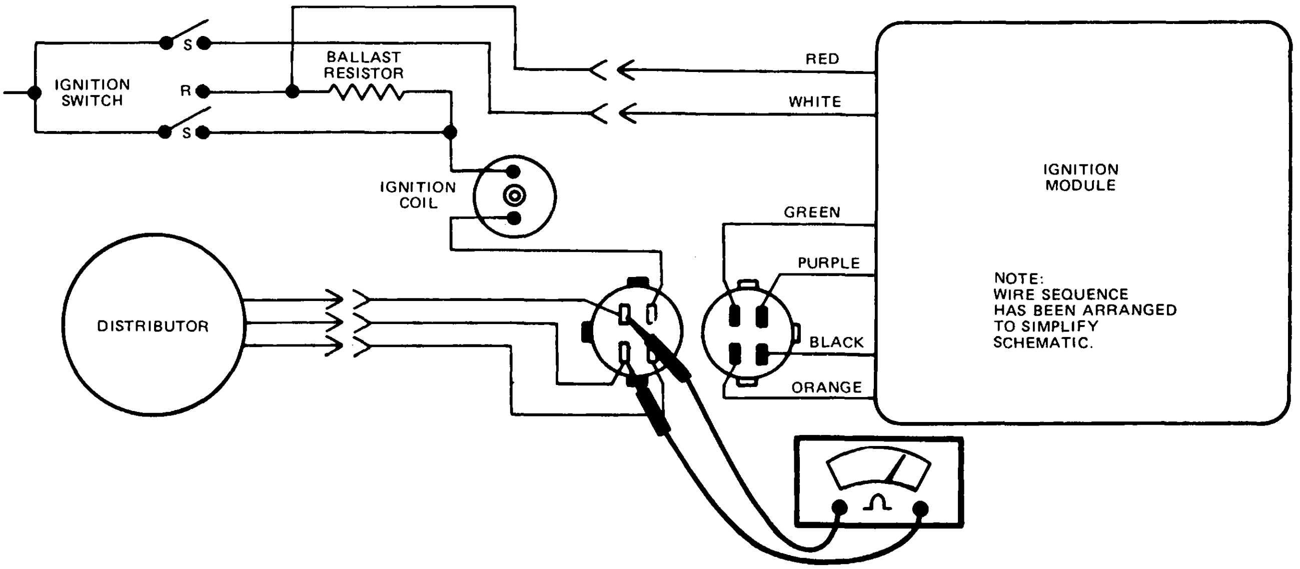
Distributor Stator Assembly and Wiring Harness

DS II

Part 2 Test 7

TEST EQUIPMENT: VOM

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
1. Separate ignition module four wire connector. Inspect for dirt, corrosion, and damage. 2. Measure stator assembly and wiring harness resistance between wiring harness terminals mating with ORANGE and PURPLE module wires. **NOTE: Wiggle wires in wiring harness when measuring.**	400 to 1,300 ohms	• Test result OK. • Go to Part 2, Test 8.
	Less than 400 or greater than 1,300 ohms	• Go to Part 2, Test 11.



A6363-C

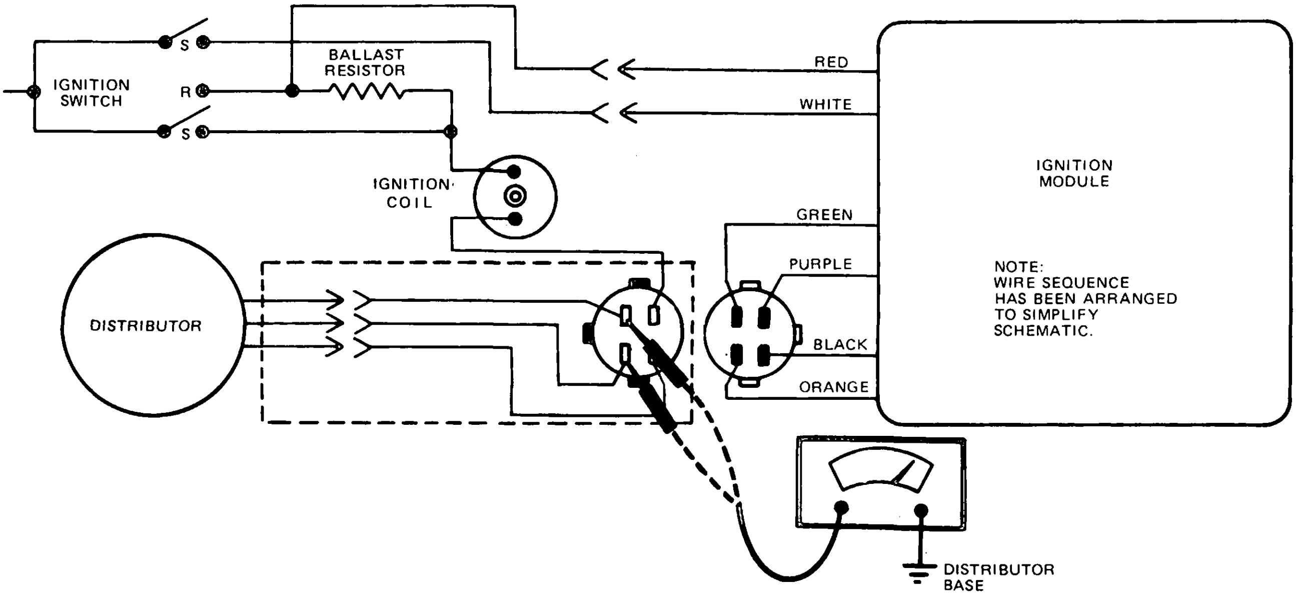
Ignition Module to Distributor Stator Assembly Wiring Harness

DS II

Part 2 Test 8

TEST EQUIPMENT: VOM

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
1. Attach one VOM lead to distributor base. 2. Alternately measure resistance between wiring harness terminals mating with ORANGE and PURPLE module wires and ground. 3. Reconnect four wire connector.	Greater than 70,000 ohms	• Test result OK. • Go to Part 2, Test 9.
	Less than 70,000 ohms	• Inspect wiring harness between module connector and distributor, including distributor grommet.



A6364-C

Ignition Coil Secondary Resistance

DS II

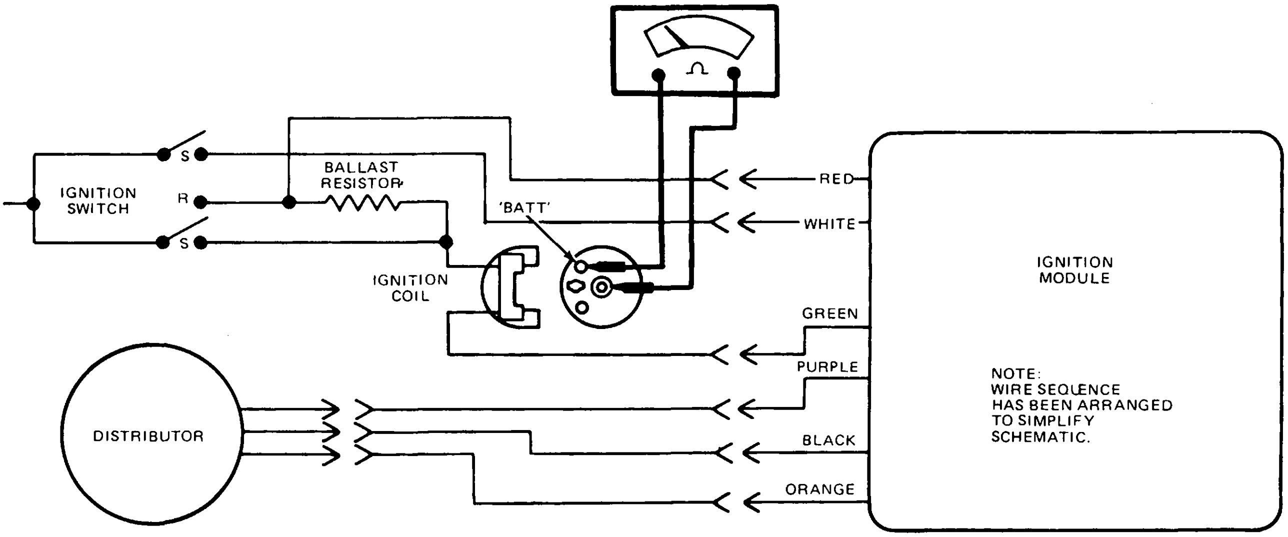
Part 2 Test 9

TEST EQUIPMENT: VOM

TEST PROCEDURE

1. Disconnect and inspect ignition coil connector and coil wire.
2. Measure secondary resistance from BATT terminal to high voltage terminal.
3. Reconnect ignition coil wire.

TEST RESULT	TEST RESOLUTION
7,700 to 10,500 ohms	• Test result OK. • Go to Part 2, Test 10.
Less than 7,700 ohms or greater than 10,500 ohms	• Replace ignition coil.



A6365-B

Module to Coil Wire

DS II

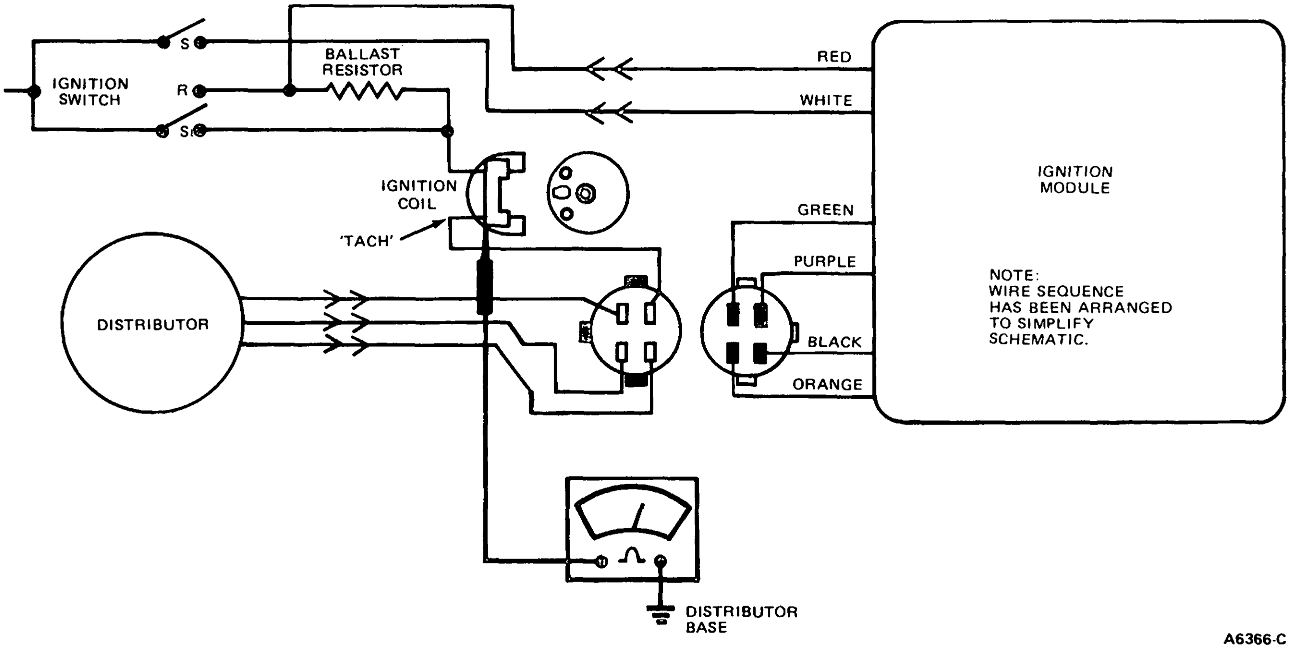
Part 2
Test 10

TEST EQUIPMENT: VOM

TEST PROCEDURE

1. Separate and inspect ignition module four wire connector and ignition coil connector from coil.
2. Connect one lead of VOM to distributor base.
3. Measure resistance between TACH terminal of ignition coil connector and ground.
4. Reconnect ignition module and coil connectors.

TEST RESULT	TEST RESOLUTION
Greater than 100 ohms	o Replace ignition module.
100 ohms or less	o Inspect wiring harness between ignition module and coil.



Distributor Stator Assembly

DS II

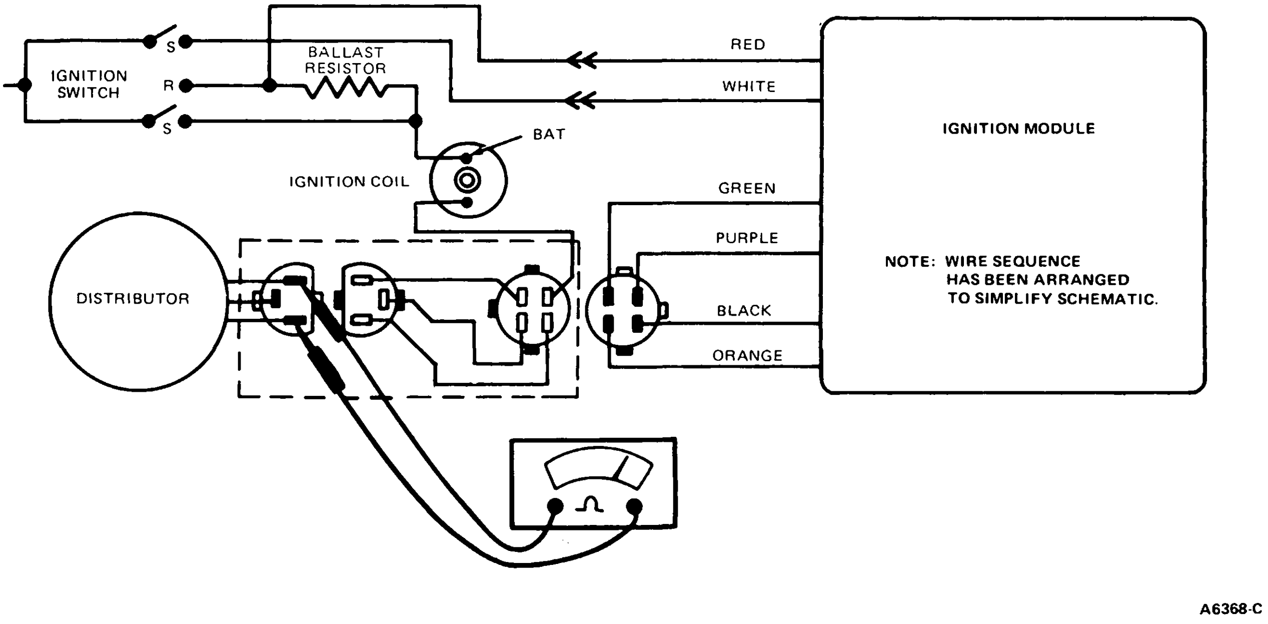
Part 2
Test 11

TEST EQUIPMENT: VOM

TEST PROCEDURE

1. Separate distributor connector from harness. Inspect for dirt, corrosion, and damage.
2. Measure stator assembly resistance across ORANGE and PURPLE wires at distributor connector.
3. Reconnect distributor and module connectors.

TEST RESULT	TEST RESOLUTION
400 to 1,000 ohms	• Test result OK. • Inspect wiring harness between distributor and ignition module.
Less than 400 or greater than 1,000 ohms	• Replace stator assembly.



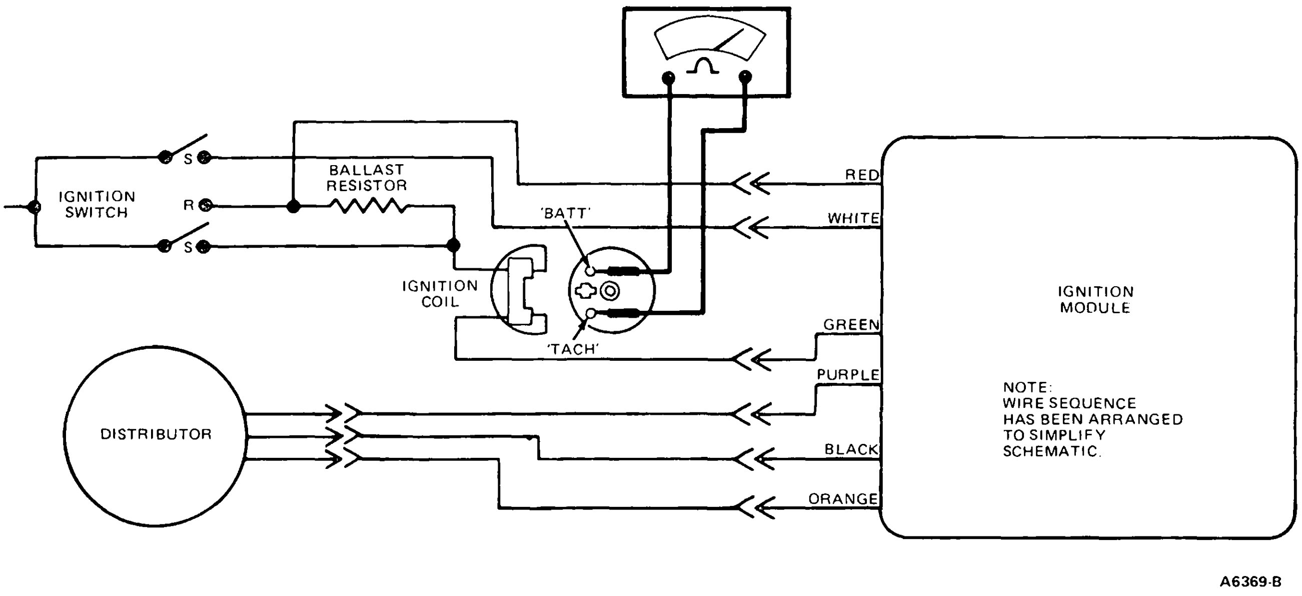
Ignition Coil Primary Resistance

DS II

Part 2 Test 12

TEST EQUIPMENT: VOM

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
1. Disconnect ignition coil connector. 2. Measure primary resistance from BATT to TACH terminal. 3. Reconnect ignition coil connector.	0.8 to 1.6 ohms	● Test result OK. ● Go to Part 2, Test 13.
	Less than 0.8 or greater than 1.6 ohms	● Replace ignition coil.



Primary Circuit Continuity

DS II

Part 2 Test 13

TEST EQUIPMENT: VOM, STRAIGHT PIN

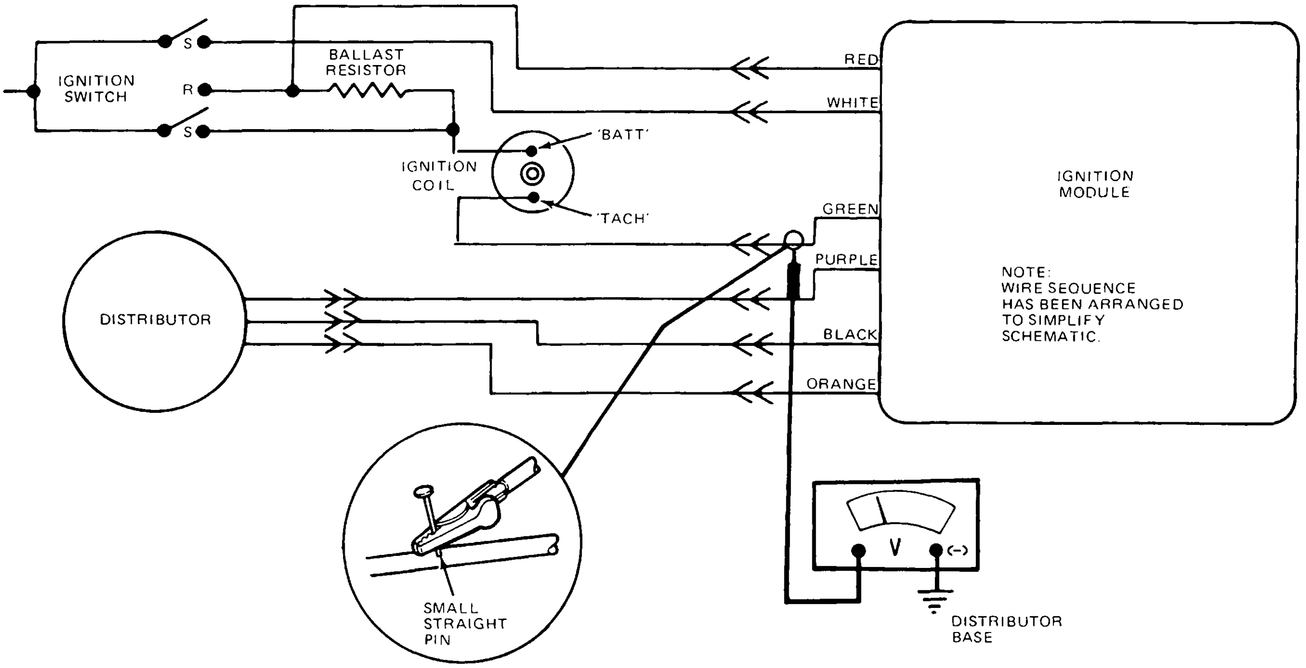
TEST PROCEDURE

1. Carefully insert small straight pin in module GREEN wire.

   CAUTION: Do not allow straight pin to contact electrical ground.

2. Attach negative (−) VOM lead to distributor base.
3. Turn ignition switch to Run position.
4. Measure voltage at GREEN module wire.
5. Turn ignition switch to Off position.
6. Remove straight pin.

TEST RESULT	TEST RESOLUTION
Greater than 1.5 volts	● Go to Part 2, Test 14.
1.5 volts or less	● Inspect wiring harness and connectors between ignition module and coil.



A6370-A

Ground Circuit Continuity

DS II

Part 2
Test 14

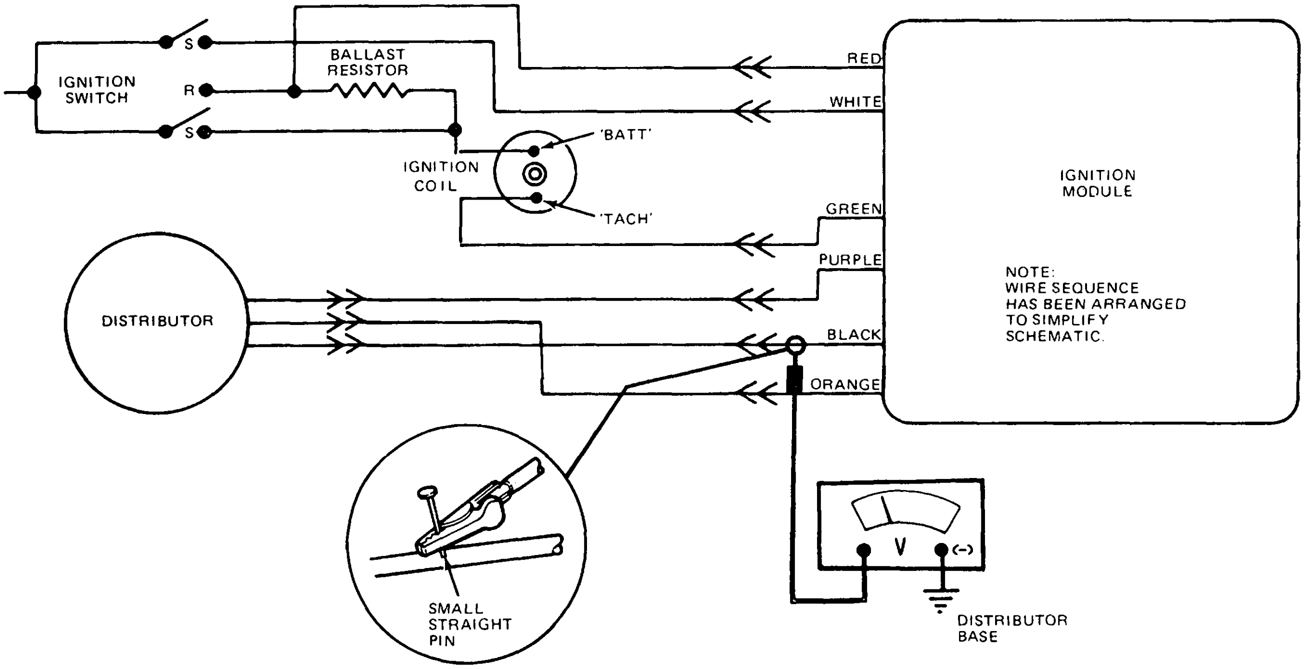
TEST EQUIPMENT: VOM, STRAIGHT PIN

TEST PROCEDURE

1. Carefully insert small straight pin in module BLACK wire.

   CAUTION: Do not allow straight pin to contact electrical ground.
2. Attach negative (–) VOM lead to distributor base.
3. Turn ignition switch to Run position.
4. Measure voltage at BLACK wire.
5. Turn ignition switch to Off position.
6. Remove straight pin.

TEST RESULT	TEST RESOLUTION
Greater than 0.5 volt	● Go to Part 2, Test 15.
0.5 volt or less	● Replace ignition module.



A6370-A

Distributor Ground Circuit Continuity

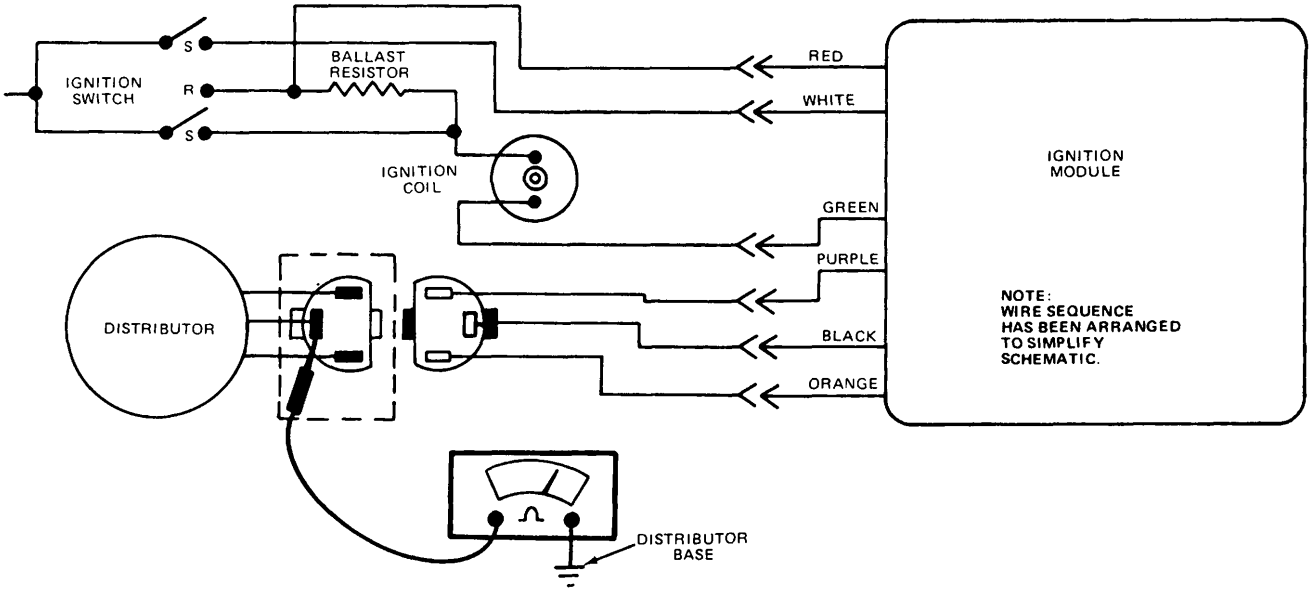
DS II

Part 2 Test 15

TEST EQUIPMENT: VOM

TEST PROCEDURE
1. Separate distributor connector from harness. Inspect for dirt, corrosion, and damage. 2. Attach one lead of VOM to distributor base. 3. Measure resistance by attaching other VOM lead to BLACK wire in distributor connector. **NOTE: Wiggle distributor grommet when measuring.** 4. Reconnect distributor connector.

TEST RESULT	TEST RESOLUTION
Less than one ohm	• Test result OK. • Inspect wiring harness and connectors between distributor and ignition module.
Greater than one ohm	• Inspect ground screw in distributor.



A6372-B

PART 2
TFI-IV
IGNITION SYSTEM

Preliminary Checkout, Equipment & Notes

CHECKOUT

- Visually inspect the engine compartment to ensure all vacuum hoses and spark plug wires are properly routed and securely connected.
- Examine all wiring harnesses and connectors for insulation damage, burned, overheated, loose, or broken conditions.
- Check that the TFI module is securely fastened to the distributor base.
- Be certain the battery is fully charged.
- All accessories should be Off during diagnosis.

EQUIPMENT

Obtain the following test equipment or an equivalent:

- Spark Tester, Special Service Tool D81P-6666-A. See note.
- Digital Volt-Ohmmeter, Rotunda 014-00407.
- 12 Volt Test Light.
- Small straight pin.

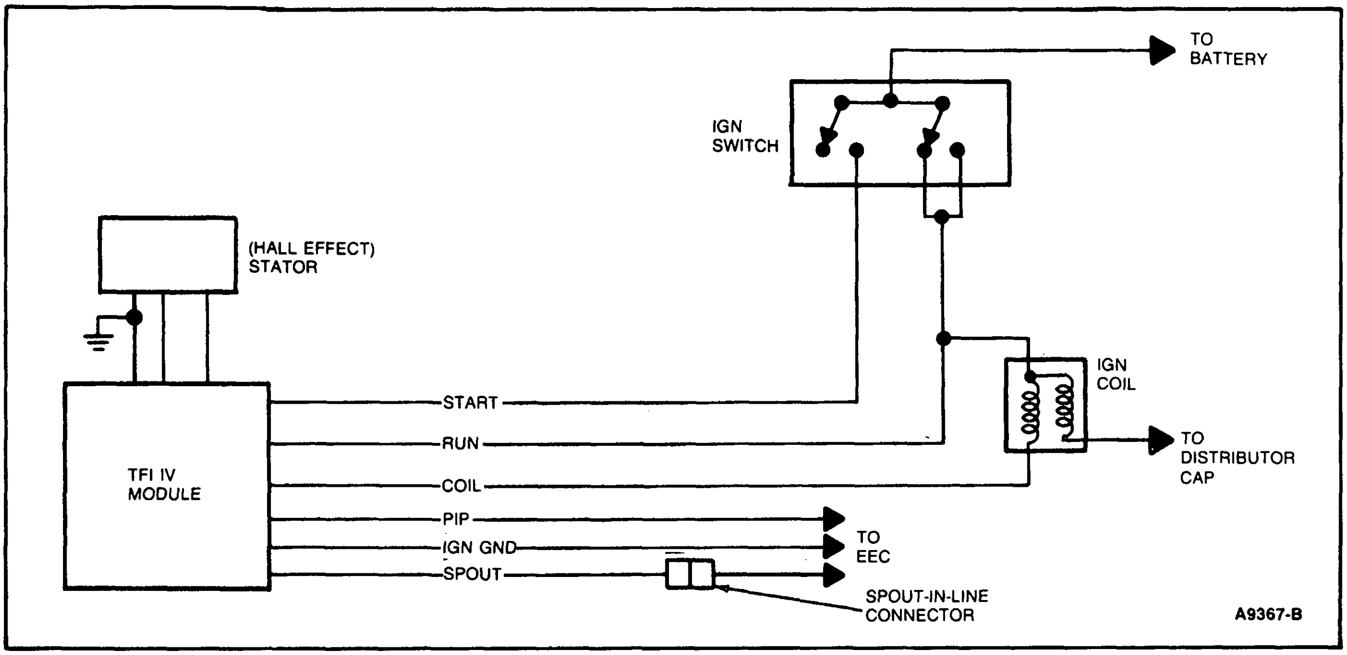
NOTES

- A spark plug with a broken side electrode **is not** sufficient to check for spark and may lead to incorrect results.
- When instructed to inspect a wiring harness, both a visual inspection and a continuity test should be performed.
- When making measurements on a wiring harness or connector, it is good practice to wiggle the wires while measuring.

Functional Schematic

TFI-IV

The TFI-IV system electrical schematic is shown below. For detailed information, refer to the vehicle wiring diagram.



Ignition Coil Secondary Voltage

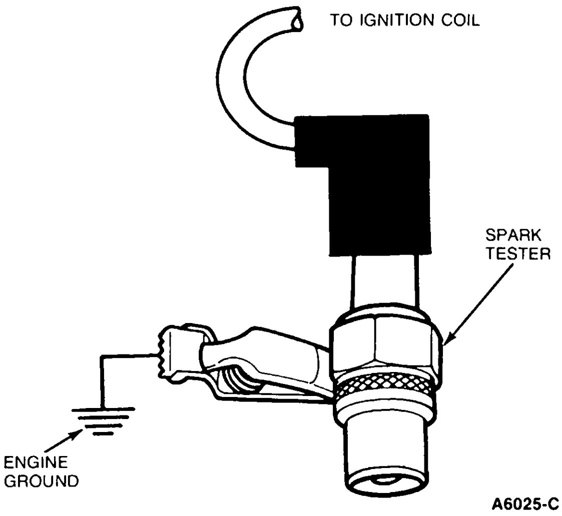
TFI-IV

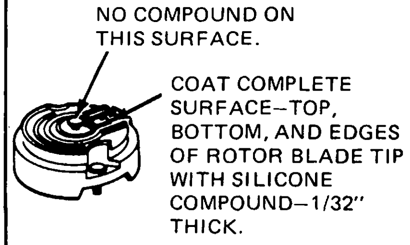
Part 2
Test 1

TEST EQUIPMENT: SPARK TESTER, VOM

TEST PROCEDURE

1. Connect spark tester between ignition coil wire and engine ground.
2. Crank engine.



TEST RESULT	TEST RESOLUTION
Spark	• Test result OK. • Inspect distributor cap, rotor for damage, carbon tracking, lack of silicone compound, if applicable. • If engine starts, Go to Part 1, Test 2, otherwise continue to Test 5.  NO COMPOUND ON THIS SURFACE. COAT COMPLETE SURFACE–TOP, BOTTOM, AND EDGES OF ROTOR BLADE TIP WITH SILICONE COMPOUND–1/32" THICK. ***DO NOT USE SILICONE COMPOUND ON MULTIPOINT ROTOR.**
No spark	• Measure resistance of ignition coil wire. Replace if greater than 7,000 ohms per foot. • Inspect ignition coil for damage, carbon tracking. • Crank engine to verify distributor rotation. Refer to Shop Manual, Group 23 and service as required. • Go to Test 2.

Ignition Coil Primary Circuit Switching

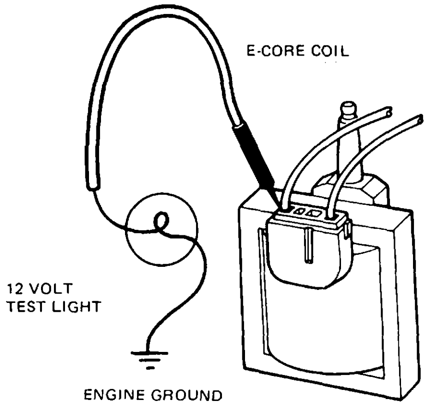
TFI-IV

Part 2 Test 2

TEST EQUIPMENT: 12V TEST LIGHT

TEST PROCEDURE
1. Separate wiring harness connector from ignition module. Inspect for dirt, corrosion, and damage. Reconnect harness. **NOTE: PUSH connector tabs to separate.** 2. Attach 12V DC test light between coil Tach terminal and engine ground. 3. Crank engine. 4. Remove test light.

TEST RESULT	TEST RESOLUTION
Light flashes or Light but no flash	• Go to Test 3.
No light or very dim light	• Go to Test 10.



A7251-B

Ignition Coil Primary Resistance

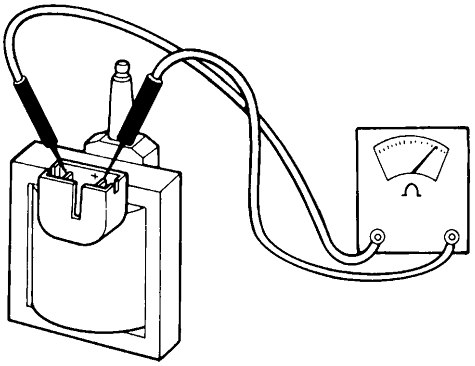
TFI-IV

Part 2 Test 3

TEST EQUIPMENT: VOM

TEST PROCEDURE
1. Turn ignition switch to Off. 2. Disconnect ignition coil connector. Inspect for dirt, corrosion, and damage. 3. Measure resistance from positive (+) to negative (—) terminal of ignition coil.

TEST RESULT	TEST RESOLUTION
0.3 to 1.0 ohm	• Test result OK. • Go to Test 4.
Less than 0.3 ohm or greater than 1.0 ohm	• Replace ignition coil.



A6385-A

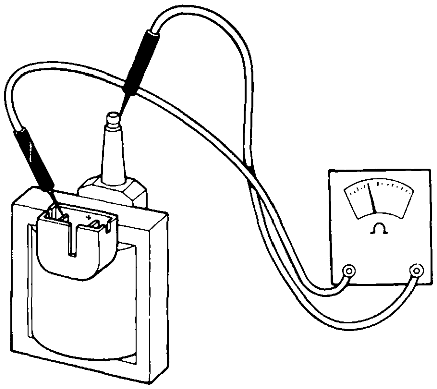
Ignition Coil Secondary Resistance

TFI-IV

Part 2
Test 4

TEST EQUIPMENT: VOM

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
1. Measure resistance from negative (−) terminal to high voltage terminal of ignition coil. 2. Reconnect ignition coil connector.	6,500 to 11,500 ohms	● Test result OK. ● Go to Test 5.
	Less than 6,500 ohms or greater than 11,500 ohms	● Replace ignition coil.



A6386-A

Wiring Harness

TFI-IV

Part 2 Test 5

TEST EQUIPMENT: VOM, STRAIGHT PIN

TEST PROCEDURE

1. Separate wiring harness connector from ignition module. Inspect for dirt, corrosion, and damage.

   NOTE: PUSH connector tabs to separate.

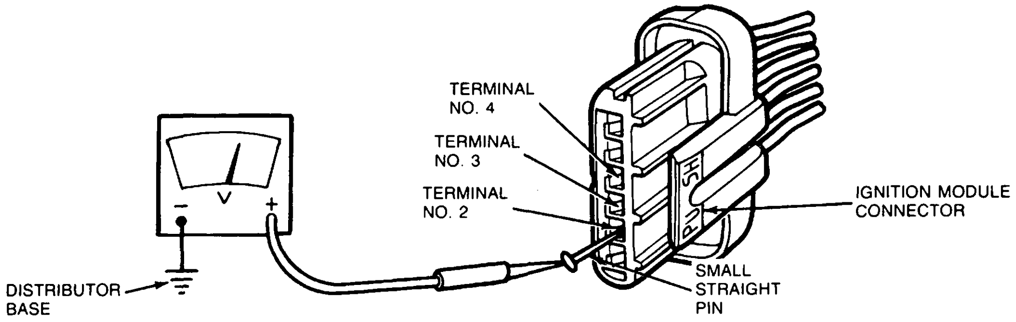
2. Disconnect wire at S terminal of starter relay.
3. Attach negative (–) VOM lead to distributor base.
4. Measure battery voltage.
5. Following table below, measure connector terminal voltage by attaching VOM to small straight pin inserted into connector terminal and turning ignition switch to position shown.

   CAUTION: Do not allow straight pin to contact electrical ground.

CONNECTOR TERMINAL	WIRE/CIRCUIT	IGNITION SWITCH TEST POSITION
#2	TO IGNITION COIL (–) TERMINAL	RUN
#3	RUN CIRCUIT	RUN AND START
#4	START CIRCUIT	START

6. Turn ignition switch to Off position.
7. Remove straight pin.
8. Reconnect wire to S terminal of starter relay.

TEST RESULT	TEST RESOLUTION
90 percent of battery voltage minimum	● Test result OK. ● Go to Part 2, Test 6.
Less than 90 percent of battery voltage	● Inspect for faults in wiring harness and connectors. ● Refer to vehicle wiring diagram for appropriate circuit. ● Damaged or worn ignition switch. Refer to Shop Manual, Group 33.



A6648-C

Stator

TFI-IV

Part 2 Test 6

TEST EQUIPMENT: VOLT-OHMMETER

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
1. Turn ignition switch to Off position. 2. Remove coil wire and ground it. 3. Attach negative (-) VOM lead to distributor base. 4. Disconnect the pin-in-line connector near distributor and attach positive (+) VOM lead to TFI module side of connector. 5. Turn ignition switch to On position. 6. Bump the starter and measure voltage levels with the engine not moving. (Allow sufficient time for digital voltage reading to stabilize before taking measurement.) Record all values for possible use in additional tests.	Highest value greater than 90 percent of battery voltage	● Go to Part 2, Test 7.
	Highest value less than 90 percent of battery voltage	Replace stator assembly.

Stator

TFI-IV

Part 2 Test 7

TEST EQUIPMENT: VOLT-OHMMETER

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
Use values obtained from Part 2, Test 6.	Lowest value greater than .5 volts	Remove distributor from engine. Remove TFI module from distributor and inspect stator connector terminals and TFI terminals for misalignment. Service as necessary. If OK, replace stator assembly.
	Lowest value less than .5 volts	Go to Part 2, Test 8.

Stator

TFI-IV

Part 2
Test 8

TEST EQUIPMENT: VOLT-OHMMETER

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
Use values obtained from Part 2, Test 6.	Values between .5 volts and 90 percent of battery voltage	Replace stator assembly.
	No values between .5 volts and 90 percent of battery voltage.	Go to Part 2, Test 9.

EEC-IV – TFI-IV

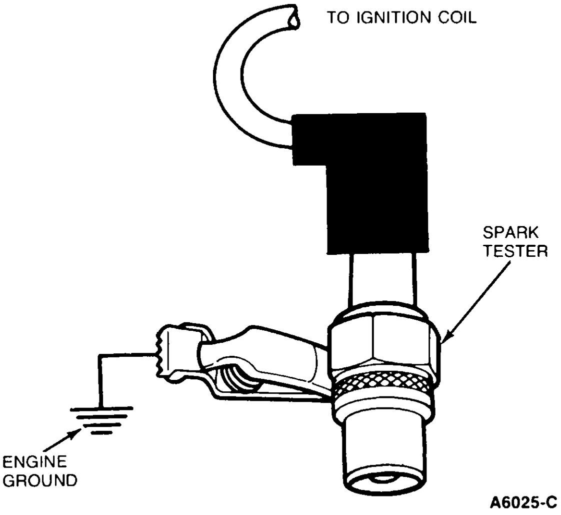
TFI-IV

Part 2 Test 9

TEST EQUIPMENT: SPARK TESTER, VOM

TEST PROCEDURE

1. Connect spark tester between ignition coil wire and engine ground.
2. Crank engine.



TEST RESULT	TEST RESOLUTION
Spark	Check PIP and Ignition ground wires for continuity. Repair as necessary. If OK, GO to EEC-IV Diagnostics.
No spark	Replace TFI-IV module.

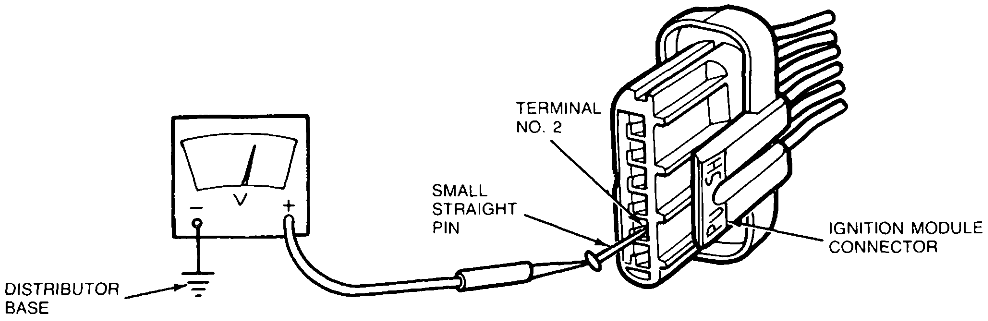
Primary Circuit Continuity

TFI-IV

Part 2 Test 10

TEST EQUIPMENT: VOM, STRAIGHT PIN

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
1. Separate wiring harness connector from ignition module. Inspect for dirt, corrosion, and damage. **NOTE: PUSH connector tabs to separate.** 2. Attach negative (−) VOM lead to distributor base. 3. Measure battery voltage. 4. Attach VOM to small straight pin inserted into connector terminal No. 2. **CAUTION: Do not allow straight pin to contact electrical ground.** 5. Turn ignition switch to Run position and measure terminal No. 2 voltage. 6. Turn ignition switch to Off position. 7. Remove straight pin.	90 percent of battery voltage minimum	● Go to Part 2, Test 5.
	Less than 90 percent of battery voltage	● Go to Part 2, Test 11.



A6649-B

Ignition Coil Primary Voltage

TFI-IV

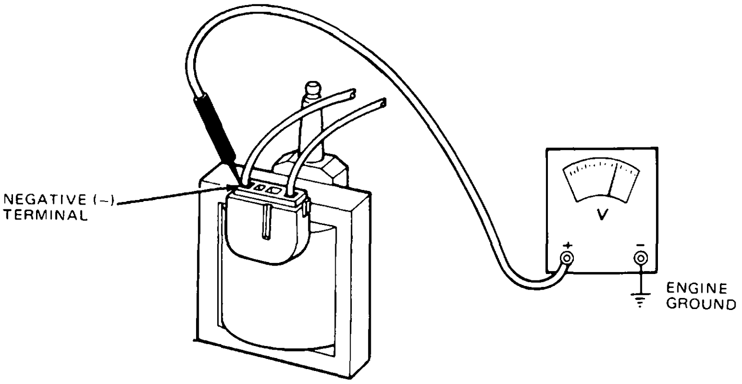
Part 2 Test 11

TEST EQUIPMENT: VOM

TEST PROCEDURE

1. Attach negative (—) VOM lead to distributor base.
2. Measure battery voltage.
3. Turn ignition switch to Run position.
4. Measure voltage at NEGATIVE (—) terminal of ignition coil.
5. Turn ignition switch to Off position.

TEST RESULT	TEST RESOLUTION
90 percent of battery voltage minimum	• Inspect wiring harness between ignition module and coil negative (—) terminal.
Less than 90 percent of battery voltage	• Inspect wiring harness between ignition module and coil negative (—) terminal. • Go to Part 2, Test 12.



A6391-A

Ignition Coil Supply Voltage

TFI-IV

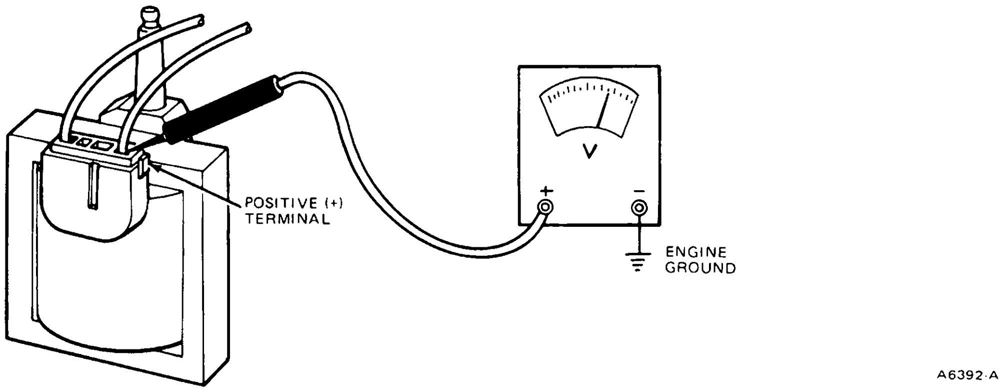
Part 2
Test 12

TEST EQUIPMENT: VOM

TEST PROCEDURE

1. Remove coil connector.
2. Attach negative (−) VOM lead to distributor base.
3. Measure battery voltage.
4. Turn ignition switch to Run position.
5. Measure voltage at POSITIVE (+) terminal of ignition coil.
6. Turn ignition switch to Off position.
7. Reconnect ignition module connector.

TEST RESULT	TEST RESOLUTION
90 percent of battery voltage minimum	• Inspect ignition coil connector for dirt, corrosion, and damage. • Inspect ignition coil terminals for dirt, corrosion, and damage. • Replace ignition coil.
Less than 90 percent of battery voltage	• Inspect and service wiring between ignition coil and ignition switch. Refer to vehicle wiring diagram. • Worn or damaged ignition switch. Refer to Shop Manual, Group 33.



PART 3
TFI-IV
IGNITION SYSTEM

Preliminary Checkout, Equipment & Notes

CHECKOUT

- Be certain the battery is fully charged.
- All accessories should be Off during diagnosis.
- Cold soak the vehicle and verify the symptom prior to performing the test procedure. The test procedure must be performed with the vehicle at or below the temperature where the symptom occurs (except as noted).

EQUIPMENT

Obtain the following test equipment or an equivalent:

- Digital Volt-Ohmmeter, Rotunda 007-00001.

Stator

TFI-IV

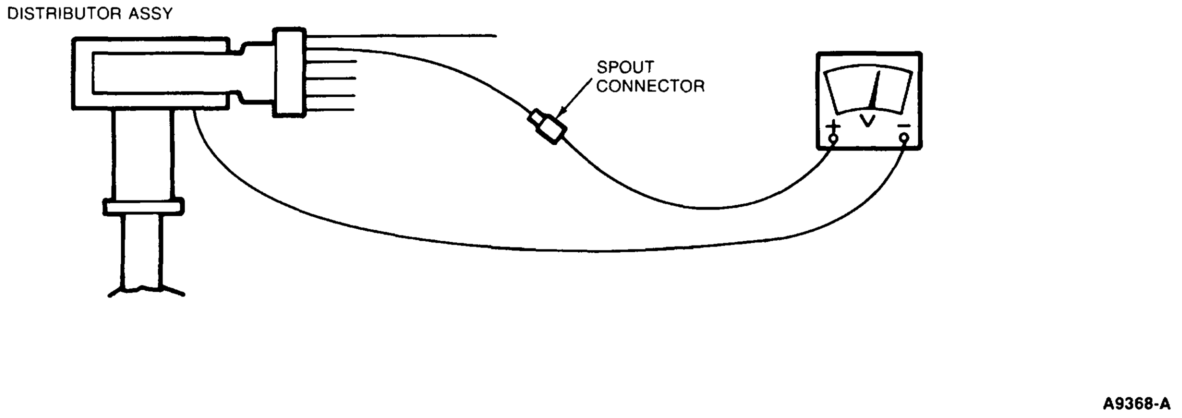
Part 3
Test 1

SYMPTOM: ROUGH IDLE OR SPARK KNOCK WHEN COLD, OK WHEN WARM

TEST PROCEDURE

1. Cold soak vehicle.
   NOTE: This procedure must be performed with the vehicle at or below temperature where symptom occurs (except where noted).
2. Key in Off position.
3. Disconnect the pin-in-line connector near the TFI module (SPOUT).
4. Attach the negative (-) VOM lead to the distributor base.
5. Start the engine and measure the battery voltage at 1200-1500 rpm.
6. Measure the voltage on the TFI module side of the pin-in-line connector at 1200-1500 rpm.
7. Is the result greater than 40 percent of the battery voltage?

TEST RESULT	TEST RESOLUTION
Yes	Go to Part 3, Test 2.
No	Replace stator assembly.



Stator

TFI-IV

Part 3 Test 2

SYMPTOM: ROUGH IDLE OR SPARK KNOCK WHEN COLD, OK WHEN WARM

TEST PROCEDURE

1. Using the same set up procedure in Part 3, Test 1, measure the voltage on the TFI module side of the pin-in-line connector at approximately 1200 rpm and at approximately 4000 rpm.
   SAFETY CAUTION: Close hood for this test.
2. Is the voltage at 4000 rpm less than 90 percent of the voltage at 1200 rpm.

TEST RESULT	TEST RESOLUTION
Yes	Replace stator assembly.
No	Go to Part 3, Test 3.

Stator

TFI-IV

Part 3 Test 3

SYMPTOM: ROUGH IDLE OR SPARK KNOCK WHEN COLD, OK WHEN WARM

TEST PROCEDURE

1. Warm the engine to normal operating temperature.
2. Using the same set-up procedure as Part 3, Test 1, measure the voltage on the TFI module side of the pin-in-line connector at 1200-1500 rpm.
3. Is the voltage obtained in Part 3, Test 1, Step 6 less than 90 percent of the voltage obtained in Step 2 of this test.

TEST RESULT	TEST RESOLUTION
Yes	Replace stator assembly.
No	Stator assembly is OK.

INTERMITTENT DIAGNOSIS PROCEDURE

Preliminary Checkout and Notes

NOTES

- This procedure begins with an owner complaint that the engine stops at unexpected times but can be restarted. In situations like this these are two things that are very important. The technician must obtain as much information directly from the owner about the conditions under which the problem occurs, and the service history of the vehicle must be thoroughly reviewed to avoid repeat replacement of good components. For example, replacing a stator assembly a second time will not correct a problem if the problem is actually in another area.

- Two testers are available for assistance with intermittent diagnosis. **Rotunda Ignition System Tester D80L-50-BIT** is used to diagnose problems in the primary circuit of the Duraspark ignition systems. It provides a means to direct the technician to a specific area in the primary circuit. **Rotunda Ignition System Tester 007-00008** provides a quick means of separating primary ignition system problems from fuel, carburetion, EGR or other system problems causing similar vehicle symptoms. It can be used on most ignition systems. It will detect any primary ignition system problem, but it is particularly useful in detection of intermittent problems.

CHECKOUT

- Visually inspect the engine compartment to ensure all vacuum hoses and spark plug wires are properly routed and securely connected.
- Examine all wiring harnesses and connectors for insulation damage, burned, overheated, loose or broken conditions.

Intermittent Diagnosis

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
STEP 1 ○ Talk to owner.		● Symptoms.
STEP 2 ○ Review vehicle service history.		● Number of previous repairs and components replaced.
STEP 3 ○ Is a Rotunda Ignition System Tester model, 007-00008 or equivalent available?	Yes	● Follow test procedure instructions supplied with tester.
	No	● Go to Step 4.
STEP 4 ○ Will engine start?	Yes	● Go to Step 5.
	No	● Go to Ignition System Diagnostic Procedure, Part 2, Test 1 for engine ignition system (Duraspark II, or TFI).

Intermittent Diagnosis

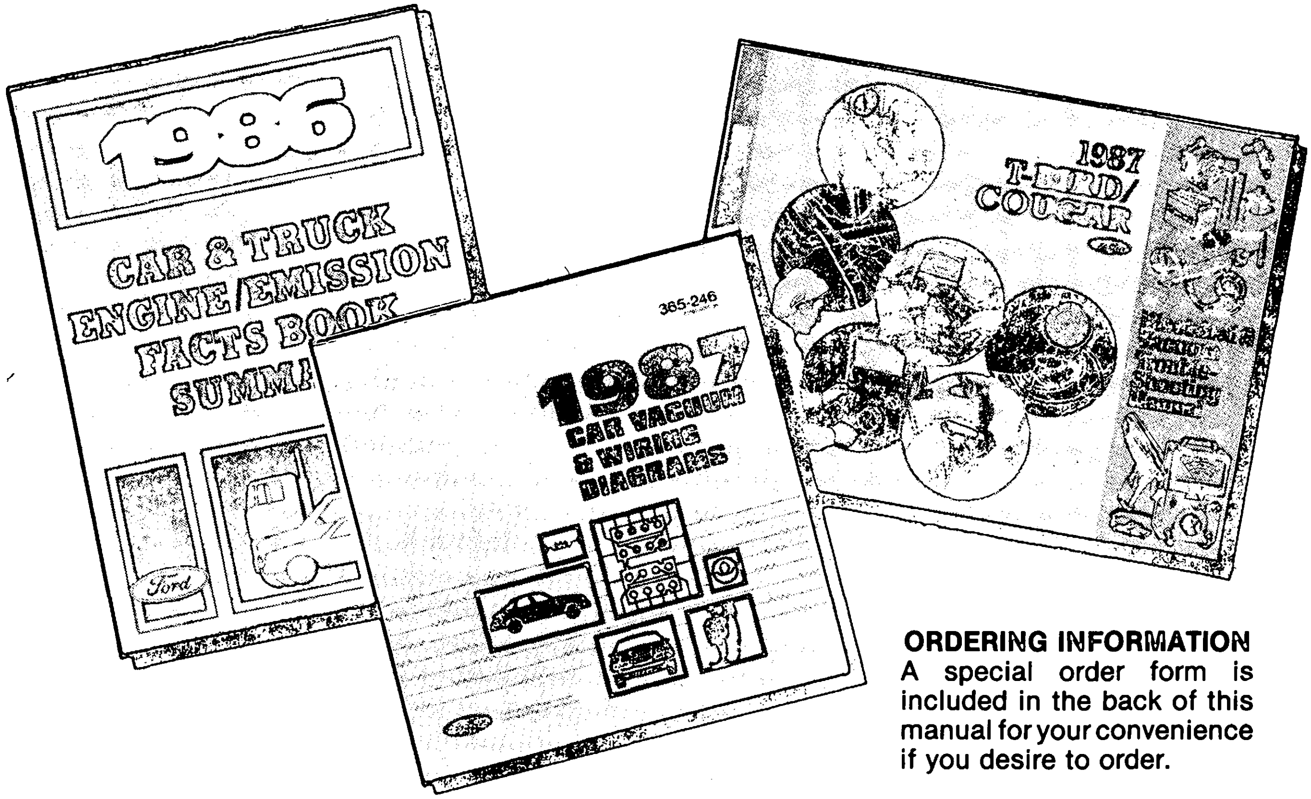
TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
STEP 5		
• Engine at idle, raise hood, shake wiring harness and pull wires at connectors for ignition components. Does engine quit?	Yes	• Repair wiring harness or connector.
	No	• Go to Step 6.
STEP 6		
• Engine at idle, close hood, A/C On, blower on medium speed: allow engine to run for 15 minutes. Does engine quit?	Yes	• Go to Step 10.
	No	• Go to Step 7.
STEP 7		
• Engine Off, hood closed, hot soak for 10 minutes. Will engine restart?	Yes	• Go to Step 8.
	No	• Go to Ignition System Diagnostic Procedure, Part 2, Test 1 for engine ignition system (Duraspark II, or TFI).
STEP 8		
• Engine at idle, raise hood, shake wiring harness and pull wires at connectors for ignition components. Does engine quit?	Yes	• Repair wiring harness or connector
	No	• Go to Step 9.

Intermittent Diagnosis

TEST PROCEDURE	TEST RESULT	TEST RESOLUTION
STEP 9 ○ Road test. Does engine quit?	Yes	• Go to Step 10.
	No	• Test complete. (Problem not duplicated).
STEP 10 ○ Raise hood, shake wiring harness, pull wires at connectors, separate and reconnect connectors for ignition components. Does engine start?	Yes	• Repair wiring harness or connector.
	No	• Go to Ignition System Diagnostic Procedure, Part 2, Test 1 for engine ignition system (Duraspark II, or TFI).

OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS



ORDERING INFORMATION
A special order form is included in the back of this manual for your convenience if you desire to order.

ENGINE EMISSIONS FACTS BOOK

- The manual contains complete specifications for each calibration number.
- Published at the conclusion of the model year.

ELECTRICAL & VACUUM TROUBLESHOOTING MANUAL (EVTM)

- Available for all passenger car and light truck vehicles, this publication provides schematics of all electrical and vacuum circuits. Wiring diagrams show how the circuit is powered. Troubleshooting hints are provided to point the technician in a general direction but are not step by step procedures.
- Available in the first quarter of the model year. (One manual for each passenger car and light truck family.)

WIRING & VACUUM DIAGRAMS

- This publication contains wiring diagrams for all Ford and Lincoln/Mercury passenger car and light truck vehicles. A Power Distribution system illustrates the power distribution throughout each vehicle. In addition, all individual electrical circuits are shown for each vehicle line.
- Available in the first quarter of the model year.

Service Specifications Manuals

(CAR AND TRUCK)

- These manuals contain all specifications including maintenance and lubrication contained in the Shop Manuals in a handy pocket size for easy reference.
- Available in the first quarter of the model year.

SECTION 16

EEC IV—Quick Test—All Engines

Contents

QUICK TEST

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Self-Test

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DIAGNOSTIC AIDS

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QUICK TEST: Test Description

SPECIAL NOTES:

- This diagnostic procedure is used **ONLY** on vehicles equipped with the fourth generation of Electronic Engine controls (EEC-IV).
- The QUICK TEST procedure should be used **ONLY** when the Diagnostic Routines, Section 2 direct you here.
- If all phases of the Quick Test, including the Diagnostic by Symptom found in the proper Engine Supplement Section, result in a PASS, it is likely that the problem is non-EEC-IV related and will be found elsewhere. You should return to the Diagnostic Routines in Section 2.
- When directed to a Pinpoint Test, look carefully at the schematic on the first page of the pinpoint test and read the STOP-WARNING below the schematic.
- Any time a repair is made, Steps 3.0, 5.0, and 6.0 should be repeated to ensure that the repair was effective.

QUICK TEST STEPS

1. Visual Check and Vehicle Preparation
2. Equipment Hookup
3. Key On Engine Off Self-Test
4. Computed Timing Check
5. Engine Running Self-Test
6. Continuous Self-Test

The Key On Engine Off and Engine Running Self-Tests detect faults that are present at the time of testing. Intermittent faults that have occurred in the last forty (40) warm-up cycles are detected during Continuous Self-Test and stored in the EEC-IV memory.

QUICK TEST: Visual Check
Vehicle Preparation

1.0

SPECIAL NOTES:

- Correct results of the QUICK TEST are dependent on the proper operation of related non-EEC-IV components.
- It may be necessary to disconnect or disassemble harness connector assemblies to do some of the inspections. Pin locations should be noted before disassembly.
- If the engine will not start, starts but stalls, idles rough, or runs rough; continue through QUICK TEST STEP 3.0 and follow the instructions in Step 3.0B.

VISUAL CHECK

1. Inspect the air cleaner and inlet ducting.
2. Check all engine vacuum hoses for damage, leaks, cracks, blockage, proper routing, etc.
3. Check EEC-IV system wiring harness for proper connections, bent or broken pins, corrosion, loose wires, proper routing, etc.
4. Check the processor, sensors, and actuators for physical damage.
5. Check the engine coolant for proper level.
6. Make all necessary repairs before continuing with QUICK TEST.

VEHICLE PREPARATION

1. Perform **ALL** safety steps required to start and run vehicle tests - apply parking brake, place shift lever firmly into PARK position (NEUTRAL on manual transmission), block drive wheels, etc.
2. Turn off **ALL** electrical loads — radios, lights, A/C-heater blower fans, etc.
3. Start engine and run until at operating temperature.
4. Turn engine off and proceed to QUICK TEST STEP 2.0.

QUICK TEST: Equipment Hookup

2.0

SPECIAL NOTES:

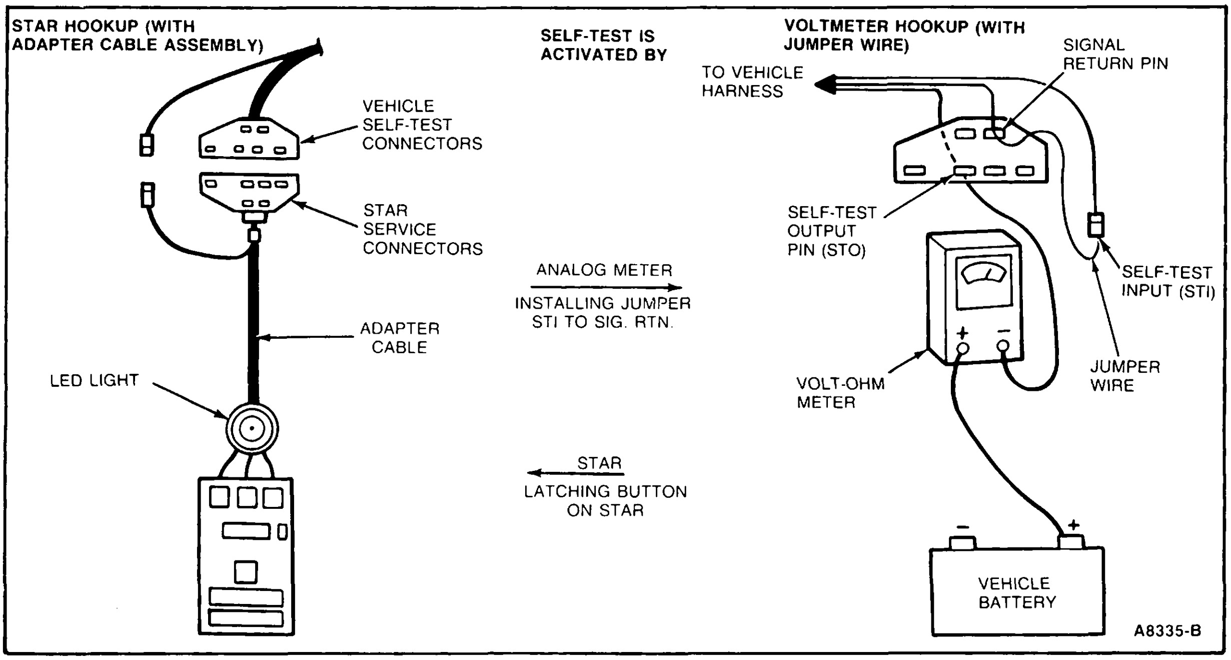
- Refer to the illustration at the bottom of this page for Self-Test connector pin orientation and VOM and STAR hookup.
- After the equipment is properly hooked up proceed to QUICK TEST STEP 3.0A.

USING THE STAR TESTER

- Turn the ignition key off.
- Connect the color coded adapter cable to the STAR tester.
- Connect the adapter cable leads to the proper Self-Test connectors.
- Connect the timing light.

USING AN ANALOG VOLT/OHM METER (VOM)

1. Turn the ignition key off.
2. Connect a jumper wire from the Self-Test Input connector to the Signal Return pin of the large Self-Test connector. DO NOT connect jumper to Signal Return unless directed to do so.
3. Set the VOM on a DC voltage range to read from 0 to 15 volts.
4. Connect the VOM from the Battery + terminal to the Self-Test Output pin of the large Self-Test connector.
5. Connect the timing light.



QUICK TEST: Key On Engine Off Self-Test

3.0

A PERFORMING THE KEY ON ENGINE OFF SELF-TEST

SPECIAL NOTES:

- It may be necessary to repair Non- EEC-IV faults before running Quick Test. Refer to Section 2.
- Continuous Memory Codes recorded in this step will be used for diagnosis after a PASS code 11 is received in both the Key On Engine Off and the Engine Running Self-Tests.
- On all vehicles equipped with a **4.9L ENGINE** the clutch must be depressed during the Key On Engine Off Self-Test.

HOW TO RUN THE KEY ON ENGINE OFF SELF-TEST

DO

- Verify that the vehicle has been properly prepared per **QUICK TEST STEPS** 1.0 and 2.0.
- Place ignition key in the ON position.
- Activate Self-Test

  —STAR Tester: Latch the center button in the down position.

  —Analog VOM: Jumper STI to SIG RTN at the Self-Test connectors.
- Record all service codes displayed.
- Go to **PART B** of Key On Engine Off Self-Test.

DON'T

- Depress throttle during Key On Engine Off Self-Test.

QUICK TEST: Key On Engine Off Self-Test

3.0

B	CODE OUTPUT		
Key On Engine Off	**Separator**	**Continuous Memory**	**ACTION TO TAKE**
11	— 1(0) —	11	• Both tests indicate a PASS. — If engine idles or runs rough, Go to DIAGNOSTIC BY SYMPTOM in the proper Engine Supplement Section. If above condition is not present, Go to Quick TEST STEP 4.0. — If engine is a no start, Go directly to Pinpoint Test Step A1.
ANY CODE(S)	— 1(0) —	11	• Key On Engine Off Self-Test indicates a FAULT. — Go to **PART C** of Key On Engine Off Self-Test. — Always start with the first code displayed.
ANY CODE(S)	— 1(0) —	ANY CODE(S)	• Both tests indicate a FAULT. — DO NOT SERVICE CONTINUOUS MEMORY CODES AT THIS TIME! — Go to **PART C** of Key On Engine Off Self-Test. — Always start with the first code displayed.
11	— 1(0) —	ANY CODE(S) EXCEPT 15	• Continuous Memory indicates a FAULT. — DO NOT SERVICE CONTINUOUS MEMORY CODES AT THIS TIME! — If engine idles or runs rough, Go to DIAGNOSTIC BY SYMPTOM in the proper Engine Supplement Section. If above condition is not present, Go to Quick TEST STEP 4.0.
11	— 1(0) —	15	• Go To Pinpoint Test Step Q10.
NO CODES OUTPUTTED CODES NOT LISTED			• Self-Test did not activate or unlisted codes displayed. — Repeat Key On Engine Off Self-Test to verify the above condition. — If condition still exists Go to Pinpoint Test Step Q1.

QUICK TEST: Key On Engine Off Self-Test

3.0

C PASSENGER CAR SERVICE CODE CHART

Key On Engine Off Service Code	Pinpoint Test Step Direction								
	1.9L EFI	1.9L CFI	2.3L EFI	2.3L TC	2.3L CFI	2.5L CFI	3.0L EFI	3.8L CFI	5.0L SEFI
13 GO to ▷	—	KB1	—	—	KB1	—	—	—	—
15 GO to ▷	Q12	Q12	Q12	Q12	Q12	Q12	Q12	Q12	Q12
19 GO to ▷	—	—	Q50	—	—	—	Q50	—	Q50
21 GO to ▷	DE1	DE1	DE1	DE1	DE1	DE1	DE1	DE1	DE1
22 GO to ▷	DF1	DF1	DF1	DF1	DF1	DF1	DF1	DF1	DF1
23 GO to ▷	DH1	KB12	DH1	DH1	KB12	DH1	DH1	DH1	DH1
24 GO to ▷	—	DB1	DB1	DB1	DB1	DB1	DB1	DB1	DB1
26 GO to ▷	DK1	—	—	DK1	—	—	—	—	—
28 GO to ▷	DA1	—	—	DA1	—	—	—	—	—
31 GO to ▷	—	DL1	DD2	—	DN1	DN1	DL1	DD2	DN1
32 GO to ▷	—	—	—	—	DN25	DN25	—	—	DN25
34 GO to ▷	—	DL8	—	—	DN20	DN20	DL8	—	DN20
35 GO to ▷	—	DL5	—	—	DN5	DN5	DL5	—	DN5
51 GO to ▷	DE10	DE10	DE10	DE10	DE10	DE10	DE10	DE10	DE10
52 GO to ▷	—	—	FF1	—	FF1	FF1	FF1	—	—
53 GO to ▷	DH3	KB15	DH3	DH3	KB15	DH3	DH3	DH3	DH3
54 GO to ▷	—	DB10	DB10	DB10	DB10	DB10	DB10	DB10	DB10
56 GO to ▷	DK10	—	—	DK10	—	—	—	—	—
58 GO to ▷	DA10	KB5	—	DA10	KB5	—	—	—	—
61 GO to ▷	DE20	DE20	DE20	DE20	DE20	DE20	DE20	DE20	DE20
62 GO to ▷	—	—	—	—	—	—	T61	—	—
63 GO to ▷	DH10	KB18	DH10	DH10	KB18	DH10	DH10	DH10	DH10
64 GO to ▷	—	DB20	DB20	DB20	DB20	DB20	DB20	DB20	DB20
66 GO to ▷	DK20	—	—	DK20	—	—	—	—	—
67 GO to ▷	FA1	FA1	FA1	FA1	FA1	FA1	T81	FA1	FA1
68 GO to ▷	DA20	KB9	—	DA20	KB9	KF1	—	KF1	—
73 GO to ▷	—	KB22	—	—	KB22	—	—	—	—
79 GO to ▷	—	—	—	—	—	—	—	—	FA4
81 GO to ▷	—	—	—	KN1	—	—	—	KC8	KC8
82 GO to ▷	—	—	—	X80	—	—	—	KC8	KC8
83 GO to ▷	—	—	DD17	X30	—	X30	X30	DD17	—
84 GO to ▷	—	DL11	DD17	KA5	DN10	DN10	DL11	DD17	DN10
85 GO to ▷	—	KD6	—	KS10	—	KD6	KD6	—	KD6
87 GO to ▷	—	J7	J7	X15	J7	X15	X15	J7	J7
88 GO to ▷	—	—	—	KS1	—	X80	—	—	—
89 GO to ▷	—	—	KR1	—	—	—	T51	KP5	—
93 GO to ▷	—	KB11	—	—	KB11	—	—	—	—
NO CODES ▷ CODES NOT LISTED ▷	GO to Pinpoint Test Step Q1								

QUICK TEST: Key On Engine Off Self-Test

3.0

C LIGHT TRUCK SERVICE CODE CHART

Key On Engine Off Service Code	Pinpoint Test Step Direction					
	2.3L EFI	**2.9L EFI**	**3.0L EFI**	**4.9L EFI**	**5.0L EFI**	**7.5L EFI**
15 GO to ▶	Q12	Q12	Q12	Q12	Q12	Q12
19 GO to ▶	Q50	Q50	Q50	Q50	Q50	Q50
21 GO to ▶	DE1	DE1	DE1	DE1	DE1	DE1
22 GO to ▶	DF1	DF1	DF1	DF1	DF1	DF1
23 GO to ▶	DH1	DH1	DH1	DH1	DH1	DH1
24 GO to ▶	DB1	DB1	DB1	DB1	DB1	DB1
31 GO to ▶	DD2	DL1	—	DN1	DN1	DN1
32 GO to ▶	—	—	—	DN25	DN25	DN25
34 GO to ▶	—	DL8	—	DN20	DN20	DN20
35 GO to ▶	—	DL5	—	DN5	DN5	DN5
51 GO to ▶	DE10	DE10	DE10	DE10	DE10	DE10
52 GO to ▶	FF1	—	FF1	FF1	FF1	—
53 GO to ▶	DH3	DH3	DH3	DH3	DH3	DH3
54 GO to ▶	DB10	DB10	DB10	DB10	DB10	DB10
61 GO to ▶	DE20	DE20	DE20	DE20	DE20	DE20
63 GO to ▶	DH10	DH10	DH10	DH10	DH10	DH10
64 GO to ▶	DB20	DB20	DB20	DB20	DB20	DB20
67 GO to ▶	FA1	FA1	FA1	FA1	FA1	FA1
81 GO to ▶	—	—	—	KC8	KC8	KC8
82 GO to ▶	—	—	—	KC8	KC8	KC8
83 GO to ▶	DD17	—	—	—	—	—
84 GO to ▶	DD17	DL11	—	DN10	DN10	DN10
85 GO to ▶	—	—	KD6	KD6	KD6	KD6
87 GO to ▶	J7	J7	J7	J7	J7	J7
89 GO to ▶	KR1	KR1	KR1	—	—	—
NO CODES ▶	GO to Pinpoint Test Step Q1					
CODES NOT LISTED ▶						

QUICK TEST: Computed Timing Check

4.0

SPECIAL NOTES:

- If engine is a NO START, go directly to Pinpoint Test Step A1.
- If engine starts but stalls, or stalls during timing check go directly to DIAGNOSTICS BY SYMPTOM in the proper Engine Supplement Section.
- Self-Test timing is equal to Base Timing plus 20 degrees BTDC ± 3 degrees (see VECI decal for correct base timing).

Example

If base timing is 10 degrees BTDC, Self-Test timing is equal to: 10 degrees + 20 degrees = 30 degrees BTDC ± 3 degrees or 27 degrees to 33 degrees BTDC.

HOW TO RUN QUICK TEST TIMING CHECK

DO

- Turn the key off and wait 10 seconds.
- Start engine.
- Activate Self-Test per Quick Test Step 3.0 A.
- Check timing after the last service code has been displayed. The timing will remain fixed for 2 minutes, unless Self-Test is deactivated.

Is Self-Test Timing within specification?

YES	Go To QUICK TEST STEP 5.0.
NO	Go To Pinpoint Test Step P 1.

QUICK TEST: Engine Running Self-Test

5.0

A PERFORMING THE ENGINE RUNNING SELF TEST

SPECIAL NOTES:

- If the engine starts but stalls, or stalls during Self-Test, go directly to DIAGNOSTICS BY SYMPTOM in the proper Engine Supplement Section.
- On vehicles equipped with 2.3L TC, 2.3L EFI (Car and Truck), 2.5L CFI, 2.9L EFI, and 3.0L EFI (Car and Truck), the brake pedal MUST be depressed and released AFTER the ID Code.
- On vehicles equipped with 2.3L CFI (Car), 4.9L and 5.0L EFI (Truck), the steering wheel must be turned one-half turn and released after the ID Code.

HOW TO RUN THE ENGINE RUNNING SELF-TEST

DO

- Deactivate Self-Test.
- Start and run engine at 2,000 rpm for 2 minutes. This action warms up the EGO sensor.
- Turn engine off, wait 10 seconds.
- Start engine.
- Activate Self-Test per Quick Test Step 3.0 A.
- After the ID code, depress and release the brake pedal if appropriate. See Special Note above.
- After the ID code, turn the steering wheel one-half turn and release it, if appropriate. See Special Note above.
- If a dynamic response code occurs, perform a brief wide open throttle (WOT).
- Record all service codes displayed.
- Go to **Part B** of Engine Running Self-Test.

DON'T

- Depress the throttle unless a Dynamic Response Code is displayed.

QUICK TEST: Engine Running Self-Test

5.0

B	CODE OUTPUT		
Engine ID	**Dynamic Response**	**Engine Running**	**ACTION TO TAKE**
2(0), 3(0) or 4(0) —	1(0) or no display —	11	o Engine Running Self-Test indicates a PASS. — If Continuous Memory Codes were present, Go to QUICK TEST STEP 6.0. — If Continuous Memory is a PASS Code 11 and a symptom is present, Go to DIAGNOSTIC BY SYMPTOM in the proper Engine Supplement Section.
2(0), 3(0) or 4(0) —	1(0) or no display —	ANY CODE(S)	o Engine Running Self-Test indicates a FAULT. — Go to **PART C** of Engine Running Self-Test. — Always start with the first code displayed.
98 —	NO DISPLAY —	ANY CODE(S)	o Code 98 in place of the I.D. code indicates that the vehicle DID NOT PASS Key On Engine Off Self-Test. Engine Running Self-Test will not initiate until a PASS Code 11 is obtained in Key On Engine Off Self-Test. — Run Key On Engine Off Self-Test and address all codes displayed.
NO CODE DISPLAYED CODES NOT LISTED			o Self-Test did not activate. — Rerun Engine Running Self-Test to verify the above condition. — If condition is still present, Go to Pinpoint Test Step Q1.

QUICK TEST: Engine Running Self-Test

5.0

C	PASSENGER CAR SERVICE CODE CHART								
Engine Running Service Code	**Pinpoint Test Step Direction**								
	1.9L EFI	**1.9L CFI**	**2.3L EFI**	**2.3L TC**	**2.3L CFI**	**2.5L CFI**	**3.0L EFI**	**3.8L CFI**	**5.0L SEFI**
12 GO to ▶	KE1	KB23	KE1	KE1	KB23	KF16	KE1	KF16	KE1
13 GO to ▶	KE4	KB26	KE15	KE11	KB26	KF19	KE11	KF19	KE11
16 GO to ▶	KE1	KB26	KE1	—	KB26	KF19	KE1	KF19	KE1
17 GO to ▶	KE12	—	—	KE12	—	—	—	—	—
18 GO to ▶	—	—	—	—	—	—	—	—	P1
19 GO to ▶	—	KB26	—	—	—	—	—	—	—
21 GO to ▶	DE1	DE1	DE1	DE1	DE1	DE1	DE1	DE1	DE1
22 GO to ▶	DF1	DF7	DF7	DF1	DF7	DF7	DF7	DF7	DF7
23 GO to ▶	DH1	KB12	DH1	DH1	KB12	DH1	DH1	DH1	DH1
24 GO to ▶	—	DB1	DB1	DB1	DB1	DB1	DB1	DB1	DB1
25 GO to ▶	—	—	DG1	DG1	—	—	DG1	—	—
26 GO to ▶	DK1	—	—	DK1	—	—	—	—	—
28 GO to ▶	DA1	—	—	DA1	—	—	—	—	—
31 GO to ▶	—	DL21	DD1	—	DN1	DN1	DL21	DD1	DN1
32 GO to ▶	—	DL20	DD11	—	DN25	DN25	DL20	DD11	DN25
33 GO to ▶	—	DL30	DD11	—	DN40	DN40	DL30	DD11	DN40
34 GO to ▶	—	DL25	DD11	KA1	DN50	DN50	DL25	DD11	DN50
35 GO to ▶	—	DL25	DD30	—	DN5	DN5	DL25	DD30	DN5
41 GO to ▶	HA14	HF6	HE14	HA14	HF6	HF6	HG15	HD7	HC9
42 GO to ▶	HA8	HF13	HE8	HA8	HF13	HF13	HG8	HD14	HC15
44 GO to ▶	—	—	—	—	—	—	—	KC1	KC1
45 GO to ▶	—	—	—	—	—	—	—	KC1	KC1
46 GO to ▶	—	—	—	—	—	—	—	KC1	KC1
47 GO to ▶	KE11	—	—	—	—	—	—	—	—
48 GO to ▶	KE20	—	—	—	—	—	—	—	—
52 GO to ▶	—	—	—	—	FF5	—	FF5	—	—
55 GO to ▶	—	FC3	—	—	FC3	FC3	—	HD1	—
58 GO to ▶	—	KB5	—	—	KB5	KF12	—	KF12	—
62 GO to ▶	—	—	—	—	—	—	T71	—	—
67 GO to ▶	—	FA1	—	—	—	—	—	—	—
72 GO to ▶	—	—	DF10	—	—	—	DF10	—	—
73 GO to ▶	DH20	—	DH20	DH20	—	—	DH20	—	—
74 GO to ▶	—	—	FD1	FD1	—	FD1	FD1	—	—
75 GO to ▶	—	—	FD4	FD4	—	FD4	FD4	—	—
76 GO to ▶	DK30	—	—	DK30	—	—	—	—	—
77 GO to ▶	M1	—	M1	M1	—	—	M1	—	—
84 GO to ▶	—	DL11	—	—	—	—	—	—	—
85 GO to ▶	—	KD6	—	—	—	—	—	—	—
91 GO to ▶	—	—	—	—	—	—	—	HD7	HC9
92 GO to ▶	—	—	—	—	—	—	—	HD14	HC15
94 GO to ▶	—	—	—	—	—	—	—	KC1	KC1
98 GO to ▶	GO TO QUICK TEST STEP 5.0B								
99 GO to ▶	ISC HAS NOT LEARNED YET. RERUN QUICK TEST STEPS 3 THRU 5								
NO CODES ▶ CODES NOT LISTED ▶	GO to Pinpoint Test Step Q1								

QUICK TEST: Engine Running Self-Test

5.0

C LIGHT TRUCK SERVICE CODE CHART

Engine Running Service Code	Pinpoint Test Step Direction					
	2.3L EFI	**2.9L EFI**	**3.0L EFI**	**4.9L EFI**	**5.0L EFI**	**7.5L EFI**
12 GO to ▷	KE1	KE1	KE1	KE1	KE1	KE1
13 GO to ▷	KE15	KE11	KE11	KE11	KE11	KE11
16 GO to ▷	KE1	KE1	KE1	KE1	KE1	KE1
21 GO to ▷	DE1	DE1	DE1	DE1	DE1	DE1
22 GO to ▷	DF7	DF7	DF7	DF7	DF7	DF7
23 GO to ▷	DH1	DH1	DH1	DH1	DH1	DH1
24 GO to ▷	DB1	DB1	DB1	DB1	DB1	DB1
25 GO to ▷	DG1	DG1	DG1	DG1	DG1	—
31 GO to ▷	DD1	DL21	—	DN1	DN1	DN1
32 GO to ▷	DD11	DL20	—	DN25	DN25	DN25
33 GO to ▷	DD11	DL30	—	DN40	DN40	DN40
34 GO to ▷	DD11	DL25	—	DN50	DN50	DN50
35 GO to ▷	DD30	DL25	—	DN5	DN5	DN5
38 GO to ▷	—	—	—	DN55	DN55	DN55
41 GO to ▷	HE14	HG15	HG15	HG15	HH15	HH15
42 GO to ▷	HE8	HG8	HG8	HG8	HH8	HH8
44 GO to ▷	—	—	—	KC1	KC1	KC1
45 GO to ▷	—	—	—	KC1	KC1	KC1
46 GO to ▷	—	—	—	KC1	KC1	—
52 GO to ▷	—	—	—	FF5	FF5	—
72 GO to ▷	DF10	DF10	DF10	DF10	DF10	DF10
73 GO to ▷	DH20	DH20	DH20	DH20	DH20	DH20
74 GO to ▷	FD1	FD1	FD1	—	—	—
75 GO to ▷	FD4	FD4	FD4	—	—	—
77 GO to ▷	M1	M1	M1	M1	M1	M1
98 GO to ▷	GO TO QUICK TEST STEP 5.0B					
NO CODES ▷ CODES NOT LISTED ▷	GO to Pinpoint Test Step Q1					

QUICK TEST: Continuous Self-Test

6.0

A CONTINUOUS MEMORY CODES

SPECIAL NOTES:

- Verify that a **Pass Code 11** was received in both Key On Engine Off and Engine Running Self-Tests before continuing with this test.
- It is necessary to clear the codes in Continuous Memory before continuing with this test.
- Refer to the Appendix for a detailed description of how to use the Continuous Monitor Mode.

HOW TO CLEAR THE CONTINUOUS MEMORY CODES

- Run the Key On Engine Off Self-Test per Quick Test Step 3.0 A.
- When the Service Codes begin to be displayed, deactivate Self-Test:

—STAR Tester: Unlatching the center button (up position).

—Analog VOM: Remove the jumper wire from between Self-Test Input (STI) connector and the Signal Return Pin of the Self-Test connector.

DETERMINING THE CONTINOUS MEMORY CODES TO BE TESTED

- Refer to the Continuous Memory Codes recorded in Quick Test Step 3.0 A.
- The cause of some of the Continuous Memory Codes may have been eliminated during either Key On Engine Off or Engine Running Self-Test repairs.
- Address only those Continuous Memory Codes for which a similar code has not been previously serviced.
- Go to **Part B** of Continuous Self-Test.

QUICK TEST: Continuous Self-Test

6.0

B HOW TO USE THE CONTINUOUS MONITOR MODE (WIGGLE TEST)

SPECIAL NOTES:

- The Continuous Monitor Modes allow the technician to **ATTEMPT** to recreate an intermittent fault.
- The STAR Tester will flash the LED or sound an alert when a fault is recreated.
- The needle of the VOM will sweep across the face of the meter when a fault is recreated.

KEY ON ENGINE OFF

- Hookup a STAR Tester or VOM as shown in Quick Test Step 2.0.
- Turn the ignition key to the ON position.
- Activate, de-activate, and re-activate Self-Test. **DO NOT** turn the ignition key off.
- You are now in the Continuous Monitor Mode.
- Tap, move, and wiggle the suspect sensor and/or harness. If a fault is detected a Service Code will be stored in memory and will be indicated as explained above depending on the type of equipment being used.
- Go To **PART C** of Continuous Self-Test.

ENGINE RUNNING

- Hookup a STAR Tester or VOM as shown in Quick Test Step 2.0.
- Start the engine.
- Activate Self-Test, wait 10 seconds, deactivate and reactivate Self-Test. **DO NOT** shut the engine off.
- You are now in the Engine Running Continuous Monitor Mode.
- Tap, move and wiggle the suspect sensor and/or harness. If a fault is detected a Service Code will be stored in memory and will be indicated as explained above depending on the type of equipment being used.
- Go to **PART C** of Continuous Self-Test.

QUICK TEST: Continuous Self-Test

6.0

C PASSENGER CAR SERVICE CODE CHART

Continuous Memory Service Code	Pinpoint Test Step Direction								
	1.9L EFI	**1.9L CFI**	**2.3L EFI**	**2.3L TC**	**2.3L CFI**	**2.5L CFI**	**3.0L EFI**	**3.8L CFI**	**5.0L SEFI**
13 GO to ▶	—	KB90	—	—	KB90	—	—	—	—
14 GO to ▶	Y1	Y1	Y1	Y1	Y1	Y1	Y1	Y1	Y1
15 GO to ▶	Q10	Q10	Q10	Q10	Q10	Q10	Q10	Q10	Q10
18 GO to ▶	N1	N1	N1	N1	N1	N1	N1	—	N1
21 GO to ▶	—	—	—	—	DE90	DE90	—	—	—
22 GO to ▶	DF90	DF90	DF90	DF90	DF90	DF90	DF90	DF90	DF90
23 GO to ▶	—	KB97	—	—	KB97	—	—	—	—
27 GO to ▶	—	—	—	DP1	—	—	—	—	—
29 GO to ▶	—	—	—	—	—	—	T2	—	DP1
31 GO to ▶	—	DL90	DD90	—	DN92	DN92	DL90	DD90	DN92
32 GO to ▶	—	DL94	—	—	DN90	DN90	DL94	—	DN90
33 GO to ▶	—	DL97	—	—	DN95	DN95	DL97	—	DN95
34 GO to ▶	—	DL93	—	—	DN98	DN98	DL93	—	DN98
35 GO to ▶	—	DL90	—	—	DN92	DN92	DL90	—	DN92
38 GO to ▶	—	KB91	—	—	KB91	—	—	—	—
39 GO to ▶	—	—	—	—	—	—	T31	—	—
41 GO to ▶	HA30	HF90	—	—	HF90	—	HG90	—	HC90
42 GO to ▶	HA30	—	—	—	—	—	—	—	—
43 GO to ▶	HA30	—	—	HA30	—	—	—	—	—
51 GO to ▶	DE91	DE91	DE91	DE91	DE91	DE91	DE91	DE91	DE91
53 GO to ▶	DH90	KB93	DH90	DH90	KB93	DH90	DH90	DH90	DH90
54 GO to ▶	—	DB90	DB90	DB90	DB90	DB90	DB90	DB90	DB90
56 GO to ▶	DK90	—	—	DK90	—	—	—	—	—
57 GO to ▶	—	—	—	—	—	—	T41	—	—
58 GO to ▶	DA90	—	—	DA90	—	—	—	—	—
59 GO to ▶	—	—	—	—	—	—	T21	—	—
61 GO to ▶	DE94	DE94	DE94	DE94	DE94	DE94	DE94	DE94	DE94
63 GO to ▶	DH94	KB97	DH94	DH94	KB97	DH94	DH94	DH94	DH94
64 GO to ▶	—	DB93	DB93	DB93	DB93	DB93	DB93	DB93	DB93
66 GO to ▶	DK93	—	—	DK93	—	—	—	—	—
67 GO to ▶	FA1	—	—	FA1	—	—	—	—	—
68 GO to ▶	DA93	—	—	DA93	—	—	—	—	—
69 GO to ▶	—	—	—	—	—	—	T11	—	—
71 GO to ▶	Q60	KB92	—	—	KB92	—	—	—	—
72 GO to ▶	B10	—	—	B10	—	—	—	—	—
78 GO to ▶	—	—	—	—	B10	X10	—	—	—
87 GO to ▶	—	J7	—	—	J7	—	J7	—	—
91 GO to ▶	—	—	—	—	—	—	—	—	HC90
NO CODES ▶ CODES NOT LISTED ▶	GO to Pinpoint Test Step Q1								

QUICK TEST: Continuous Self-Test

6.0

C LIGHT TRUCK SERVICE CODE CHART

Continuous Memory Service Code	Pinpoint Test Step Direction					
	2.3L EFI	**2.9L EFI**	**3.0L EFI**	**4.9L EFI**	**5.0L EFI**	**7.5l EFI**
14 GO to ▷	Y1	Y1	Y1	Y1	Y1	Y1
15 GO to ▷	Q10	Q10	Q10	Q10	Q10	Q10
18 GO to ▷	N1	N1	N1	N1	N1	N1
21 GO to ▷	—	—	—	—	—	—
22 GO to ▷	DF90	DF90	DF90	DF90	DF90	DF90
29 GO to ▷	—	DP1	—	DP1	DP1	—
31 GO to ▷	DD90	DL90	—	DN92	DN92	DN92
32 GO to ▷	—	DL94	—	DN90	DN90	DN90
33 GO to ▷	—	DL97	—	DN95	DN95	DN95
34 GO to ▷	—	DL93	—	DN98	DN98	DN98
35 GO to ▷	—	DL90	—	DN92	DN92	DN92
41 GO to ▷	—	HG90	—	HG90	HH90	HH90
51 GO to ▷	DE91	DE91	DE91	DE91	DE91	DE91
53 GO to ▷	DH90	DH90	HD90	DH90	DH90	DH90
54 GO to ▷	DB90	DB90	DB90	DB90	DB90	DB90
61 GO to ▷	DE94	DE94	DE94	DE94	DE94	DE94
63 GO to ▷	DH94	DH94	DH94	DH94	DH94	DH94
64 GO to ▷	DB93	DB93	DB93	DB93	DB93	DB93
87 GO to ▷	—	J7	—	J7	J7	J7
NO CODES ▷	GO to Pinpoint Test Step Q1					
CODES NOT LISTED ▷						

APPENDIX: Self-Test Description

The Self-Test is divided into three specialized tests: Key On Engine Off Self-Test, Engine Running Self-Test, and Continuous Self-Test. The Self-Test is not a conclusive test by itself, but is used as a part of the functional Quick-Test diagnostic procedure. The processor stores the Self-Test program in its permanent memory. When activated, it checks the EEC-IV system by testing its memory integrity and processing capability, and verifies that various sensors and actuators are connected and operating properly.

The Key On Engine Off and Engine Running Self-Tests are functional tests which only detect faults present at the time of the Self-Test. Continuous Self-Test is an ongoing test that stores fault information for retrieval at a later time.

KEY ON ENGINE OFF SELF-TEST

At this time, a test of the EEC-IV system is conducted with power applied and engine at rest.

For Self-Test to detect errors in the Key On Engine Off Self-Test mode, the fault must be present at the time of testing. For intermittents, refer to Continuous Memory Codes.

SEPARATOR PULSE

A single 1/2 second separator pulse is issued 6-9 seconds after the last Key On Engine Off Test code. Then 6-9 seconds after the single 1/2 second separator pulse, the continuous memory codes will be issued.

NOTE: The separator code and continuous memory codes follow Key On Engine Off Testing codes ONLY.

CONTINUOUS MEMORY CODES

Continuous memory codes are issued as a result of information stored during continuous Self-Test, while the vehicle was in normal operation. These codes are displayed only during Key On Engine Off testing and after the separator code. These codes should be used for diagnosis only when Key On Engine Off and Engine Running Self-Tests result in code 11 and all Quick Test Steps 1.0 through 5.0 have been successfully completed.

ENGINE RUNNING SELF-TEST

At this time, a test of the EEC-IV system is conducted with the engine running. The sensors are checked under actual operating conditions and at normal operating temperatures. The actuators are exercised and checked for corresponding results.

ENGINE IDENTIFICATION CODES (ID CODES)

Engine ID codes are issued at the beginning of the Engine Running Self-Test and are one-digit numbers represented by the number of pulses sent out. The engine ID code is equal to 1/2 the number of engine cylinder (i.e. 2 pulses = 4 cylinders). These codes are used to verify the proper processor is installed and that the Self-Test has been entered.

DYNAMIC RESPONSE CHECK

The dynamic response check verifies the movement of the TP, VAF, and MAP sensors during the brief Wide Open Throttle (WOT) performed during the Engine Running Self-Test. The signal for the operator to perform the brief WOT is a single pulse or 10 code on the STAR Tester.

APPENDIX: Self-Test Description

POWER STEERING PRESSURE SWITCH TEST

On vehicles equipped with 2.3L CFI (Car), 4.9L and 5.0L EFI (Truck), the steering wheel must be turned one-half turn and released AFTER the ID Code. This tests the ability of the EEC-IV system to detect a change of state in the Power Steering Pressure Switch.

BRAKE ON/OFF SWITCH TEST

On vehicles equipped with 2.3L TC, 2.3L EFI (Car and Truck), 2.5L CFI, 2.9L EFI, and 3.0L EFI (Car and Truck), the brake pedal MUST be depressed and released AFTER the ID Code. This tests the ability of the EEC-IV system to detect a change of state in the Brake ON/OFF Switch.

APPENDIX: Code Output Format

SERVICE CODES

The EEC-IV system communicates service information to the outside world by way of the Self-Test service codes. These service codes are two-digit numbers representing the results of Self-Test.

The service codes are transmitted on the Self-Test output (STO) line found in the vehicle Self-Test connector. They are in the form of timed pulses, and read by the technician on a voltmeter or on the STAR tester.

SELF-TEST OUTPUT CODE FORMAT
KEY ON ENGINE OFF AND CONTINUOUS MEMORY CODES

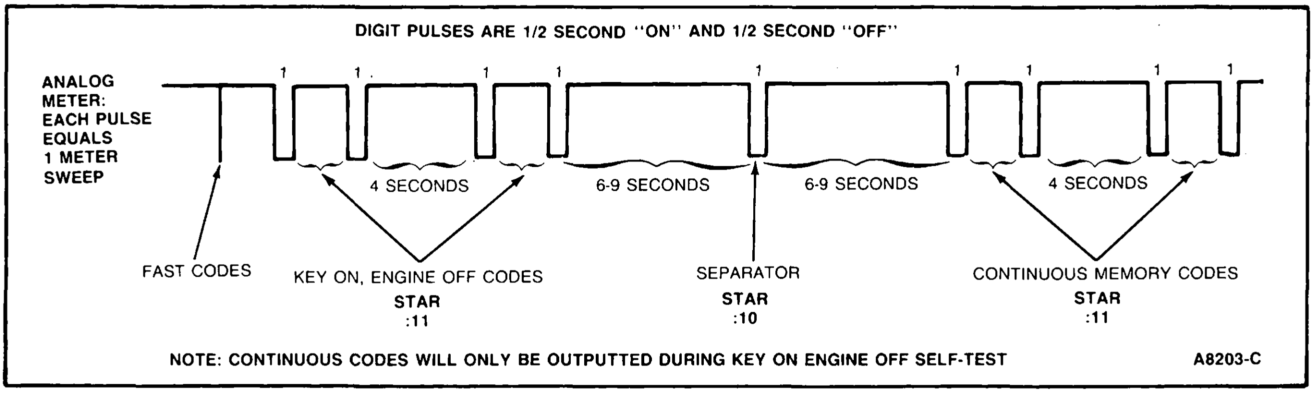

DIGIT PULSES ARE 1/2 SECOND "ON" AND 1/2 SECOND "OFF"
ANALOG METER: EACH PULSE EQUALS 1 METER SWEEP
1
1
1
1
1
1
1
1
1
4 SECONDS
6-9 SECONDS
6-9 SECONDS
4 SECONDS
FAST CODES
KEY ON, ENGINE OFF CODES
STAR :11
SEPARATOR
STAR :10
CONTINUOUS MEMORY CODES
STAR :11
NOTE: CONTINUOUS CODES WILL ONLY BE OUTPUTTED DURING KEY ON ENGINE OFF SELF-TEST
A8203-C

Figure 1 Key On Engine Off and Continuous Memory Code Format

SELF-TEST OUTPUT CODE FORMAT
ENGINE RUNNING CODES

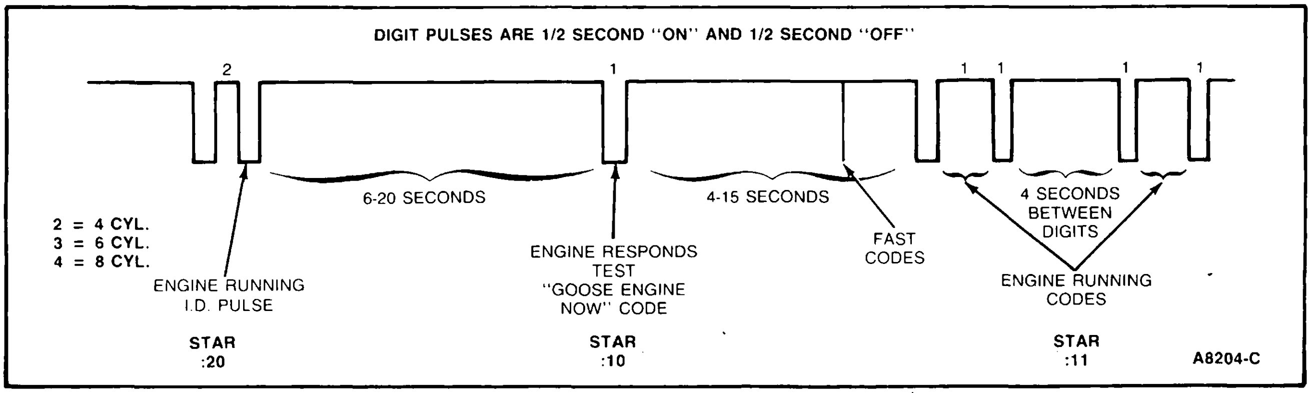


Figure 2 Engine Running Self-Test Code Format

Fast Codes

Fast codes are issued prior to regular service codes. These codes contain the identical information as the regular service codes but are transmitted at 100 times the normal rate. These codes are interpreted by special equipment at the end of the assembly line by the Body and Assembly Division.

Some meters in service detect these codes as a short burst of information (slight meter deflection).

APPENDIX: Continuous Self-Test

The Continuous Memory service codes are separated from the Quick Test Key On Engine Off codes by a single separator pulse, Figure 3.

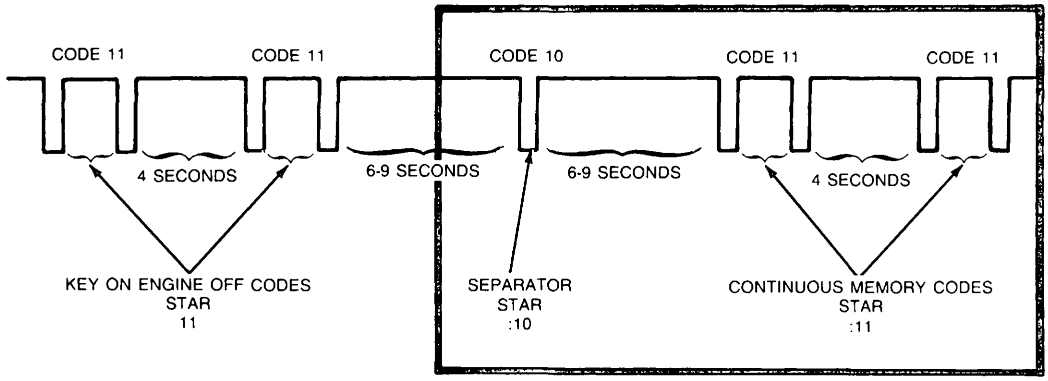


Figure 3 Continuous Memory Code Format

The Continuous Memory codes should never be used for Diagnosis until the Key On Engine Off and Engine Running Self-Tests result in a pass code 11.

During this mode of testing the EEC-IV Processor continuously monitors inputs for opens and shorts. The continuous memory codes must be retrieved within forty engine temperature warm up cycles. On the forty-first Engine Temperature cycle the service code will be automatically erased. The continuous memory codes can also be erased by deactivating Self-Test while the service codes are being outputted.

APPENDIX: Self-Test With STAR Tester

READING CODES—SELF-TEST AUTOMATIC READOUT (STAR) TESTER

After hooking up the STAR tester and turning on its power switch, the tester will run a display check and the numerals 88 will begin to flash in the display window (Figure 4). A steady 00 will then appear to signify that the STAR tester is ready to start the Self-Test and receive the test's service codes.

To receive the service codes, press the pushbutton at the front of the STAR tester. The button will latch down, and a colon will appear in the display window in front of the 00 numerals. The colon **must** be displayed to receive the service codes.

If for any reason the technician wishes to clear the display window during the Self-Test, he must turn off the vehicle's engine, press the tester's pushbutton once to unlatch it (colon will disappear), then press the button again to latch down the button (colon will appear again). Every time the STAR tester is turned off, the low battery indicator (LO BAT) should show briefly at the upper left corner of the tester's display window. If the LO BAT indicator shows steadily at any other time during the operation of the STAR tester with any service code, turn its power switch to Off and replace the 9-volt battery in the tester.

The STAR tester will display the last service code received, even after disconnecting it from the vehicle. It will hold the service code on the display until the power is turned off or the pushbutton is unlatched and relatched.

WARNING: Anyone who departs from the instructions provided in this publication must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools, or parts.

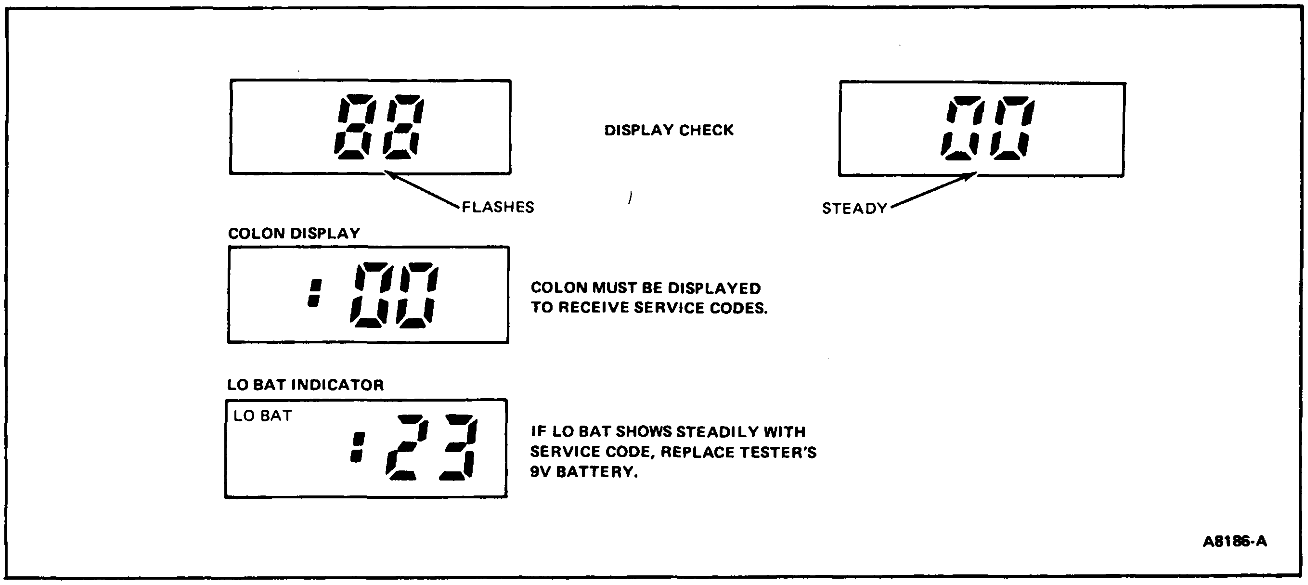

88
DISPLAY CHECK
00
FLASHES
STEADY
COLON DISPLAY
:00
COLON MUST BE DISPLAYED TO RECEIVE SERVICE CODES.
LO BAT INDICATOR
LO BAT
:23
IF LO BAT SHOWS STEADILY WITH SERVICE CODE, REPLACE TESTER'S 9V BATTERY.
A8186-A

Figure 4 Star Tester Output Code Format

APPENDIX: Self-Test With Analog Voltmeter

READING CODES—ANALOG VOLTMETER

When a service code is reported on the analog voltmeter for a function test, it will represent itself as a pulsing or sweeping movement of the voltmeter's needle across the dial face of the voltmeter (Figure 5). Therefore, a single-digit number of three will be reported by three needle pulses (sweeps). However, as previously stated, a service code is represented by a two-digit number, such as 2-3. As a result, the Self-Tests service code of 2-3 will appear on the voltmeter as two needle pulses (sweeps), then, after a two-second pause, the needle will pulse (sweep) three times.

The continuous memory codes are separated from the Key On Engine Off codes by a six-second delay, a single half-second sweep, and another six-second delay. They are produced on the voltmeter in the same manner as the Key On Engine Off codes.

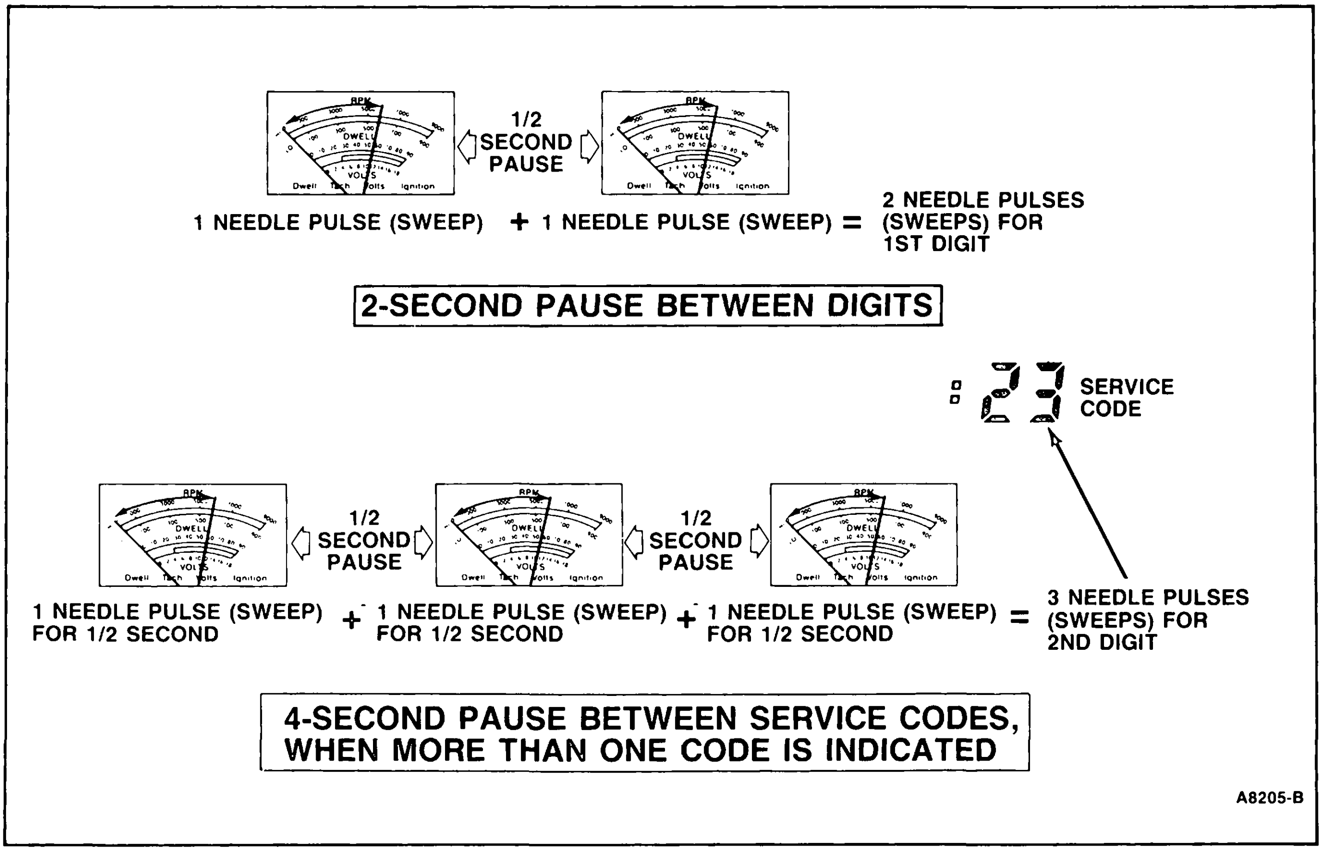

1/2 SECOND PAUSE
1 NEEDLE PULSE (SWEEP) + 1 NEEDLE PULSE (SWEEP) = 2 NEEDLE PULSES (SWEEPS) FOR 1ST DIGIT
2-SECOND PAUSE BETWEEN DIGITS
23 SERVICE CODE
1/2 SECOND PAUSE
1/2 SECOND PAUSE
1 NEEDLE PULSE (SWEEP) FOR 1/2 SECOND + 1 NEEDLE PULSE (SWEEP) FOR 1/2 SECOND + 1 NEEDLE PULSE (SWEEP) FOR 1/2 SECOND = 3 NEEDLE PULSES (SWEEPS) FOR 2ND DIGIT
4-SECOND PAUSE BETWEEN SERVICE CODES, WHEN MORE THAN ONE CODE IS INDICATED
RPM
DWELL
VOLTS
Dwell Tach Volts Ignition
A8205-B

Figure 5 Analog Voltmeter Output Code Format

APPENDIX: Diagnostic Aids

CONTINUOUS MONITOR TEST (WIGGLE TEST)

This test is intended as an aid in diagnosing intermittent failures in the sensor input circuits. The Self-Test output is energized whenever the continuous memory mode senses a fault and de-energized when the system is OK.

- Connect a VOM/STAR to the Self-Test output.
- **Key On Engine Off/Engine Running** Continuous Monitor Test, (Wiggle Test).

Continuous Monitor Test is entered by activating, de-activating, and re-activating Self-Test (DO NOT turn key off). This will put you into Continuous Monitor ("Wiggle") Test. The Engine Running Continuous Monitor Test can also be entered by waiting approximately two minutes after the last service codes are received.

The Continuous Monitor (Wiggle) Test will allow the technician to attempt to re-create the intermittent failure (tap, move, wiggle the harness and/or the suspected sensor). The Self-Test output will be activated whenever a continuous fault is detected. If the duration is long enough, a fault code will be stored.

Now with the knowledge of the affected circuits, a close check of the harness and associated connectors can be made.

NOTE: **Remember to keep your eyes on the VOM/STAR for any change which will indicate where the intermittent is located.**

EXAMPLE: How to Use the Continuous Monitor Test (Systematically)

If a service code 51 was displayed: Engine Coolant Temperature Sensor:

- Visually inspect the sensor **very closely.**
- Enter Continuous Monitor test.
- Lightly TAP on the sensor.
- Push/pull on the sensor harness connector (do not disconnect, yet).
- Test and Wiggle (shake) harness vigorously working from the sensor connector toward the dash panel and from the dash panel to the processor in short sections.
- If VOM has not given a positive indication of an intermittent, disconnect the sensor from the harness as carefully as possible. Remove terminals from the connector. Visually inspect terminals at both ends for corrosion, bad crimps, improperly seated terminals, etc.
- Reconnect after inspection.
- Disconnect processor from harness as carefully as possible.
- Inspect terminals.
- Only remove terminals associated with the sensor being inspected.
- If the VOM does not give a positive intermittent indication, reconnect the connector and erase the Continuous Test service codes.
- To erase the continuous memory service codes:
  - — Initiate Key On Engine Off Self-Test.
  - — Unlatch the push-button on the Star Tester as soon as the **first** service code is received (even if an "11" is the first code).
  - — Rerun Self-Test to verify services have been erased.

APPENDIX: Diagnostic Aids

OUTPUT STATE CHECK

The output state check aids in servicing output actuators associated with the EEC-IV system. It enables the technician to energize and de-energize most of the system output actuators on command. This mode is entered after all codes have been received from Key On Engine Off and Continuous Testing. At this time, leave Self-Test activated and depress the throttle. Each time the throttle is depressed the output actuators will change state from energized to de-energized or from de-energized to energized.

1. Enter Self-Test.
2. Code Output Ends.
3. Do Brief WOT.
4. EEC-IV Output To Actuators Energized.
5. Do Brief WOT.
6. EEC-IV Output To Actuators De-Energized.

CYLINDER BALANCE TEST

All Applications Except Mark VII/Lincoln Town Car Calibration 8-22

The Cylinder Balance Test on the 5.0L SEFI is designed to separately check each injector and injector circuit. By switching each injector off and on, one at a time, Self-Test will verify that an rpm drop of greater than 80 rpm results.

To enter the Cylinder Balance Test:

1. Perform Engine Running Self-Test.
2. After the last REPEATED service code is received wait approximately 10 seconds. (The test must be entered within 2 minutes of the last repeated service code.)
3. Lightly depress throttle. (A two to three degree throttle angle shaft movement is required, NOT wide open throttle.)
4. Test time is approximately 90 seconds.
5. The Cylinder Balance Test can be repeated (entered) as many times as necessary, by lightly depressing the throttle within two minutes after the last repeated service code has been displayed.

The Cylinder Balance Test service codes are listed in Pinpoint Test Step HC4.

The Cylinder Balance Test is designed to aid in the detection of a non-contributing cylinder. The Cylinder Balance Pinpoint Test Steps are designed to isolate only EEC related problems

CYLINDER BALANCE TEST (Continued)

Mark VII/Lincoln Town Car Calibration 8-22

The Cylinder Balance Test on the Mark VII/Lincoln Town Car calibration 8-22 has been modified to test rpm drop at three levels, allowing a more precise check of each cylinder. During first level testing, Cylinder Balance Test will verify that when each injector is separately turned "off and on", an rpm drop of greater than 80 rpm results. When a second test level is requested, an rpm drop of greater than 90 rpm must result. When a third test level is requested, a drop of greater than 100 rpm must result. Any additional tests (ie. fourth test, fifth test, etc.) that are requested will be run at the third level (100 rpm).

The Cylinder Balance Test service codes are listed in Pinpoint Test Step HC4.

1. Perform Engine Running Self-Test.
2. After the last repeated service code is received, wait 5-10 seconds.
3. Lightly depress and release throttle (not wide-open throttle) within two minutes of the last repeated service code.
4. Cylinder Balance Test will be performed at the first test level (80 rpm). Test time is approximately three minutes.
5. After the last repeated Cylinder Balance Test pass code 90, re-enter test within two minutes by lightly depressing and releasing the throttle. The second test level of the Cylinder Balance Test will now be performed (90 rpm).
6. After the last repeated Cylinder Balance Test pass code 90, re-enter test within two minutes by lightly depressing and releasing the throttle. Cylinder Balance Test will now be tested at the third test level (100 rpm).
7. Cylinder Balance Test may be repeated as many times as necessary by repeating Step 6. All additional testing will be performed at the third test level (100 rpm).

The Cylinder Balance Test is designed to aid in the detection of a non-contributing or partially contributing cylinder. The Cylinder Balance Pinpoint Test Steps are designed to isolate only EEC related problems.

APPENDIX: Failure Mode Effects Management (FMEM)

DESCRIPTION

FMEM is an alternate system strategy in the ECA designed to allow improved vehicle drive should one or more sensor inputs fail.

When a sensor input is perceived to be out-of-limits by the ECA, an alternative strategy will be initated.

The ECA will substitute a fixed in-limit sensor value and will continue to monitor the faulty sensor input. If the faulty sensor operates within limits, the ECA will return to the normal engine running strategy.

98 — Code 98 will be displayed when FMEM is in effect.

MIL — MIL "Check Engine" Light will remain on when FMEM is in effect.

APPENDIX: "Check Engine" Light (Malfunction Indicator Light)

DESCRIPTION

The "Check Engine" light is intended to alert the driver of certain malfunctions in the engine control system.

If such a fault occurs, the EEC-IV processor will substitute a value or values and continue operating. This process is called Failure Mode Effects Management (FMEM). In some cases this action may result in a slight change in driveability.

HOW THE "CHECK ENGINE" LIGHT OPERATES

System OK

The "Check Engine" light will remain on while the key is in the RUN position.

Once the vehicle has started the "Check Engine" light will go out.

System Not OK

If the "Check Engine" light should remain on after the vehicle has started, run Key On Engine Off Self-Test to completion. If the light continues to remain on, go to EEC-IV Diagnostic By Symptom.

If the "Check Engine" light never comes on, go to EEC-IV Diagnostic By Symptom.

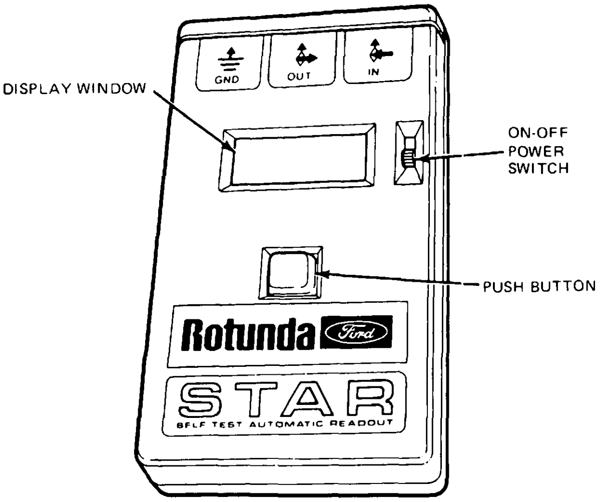
If the vehicle is a no start, go to Pinpoint Test Step A1.

NOTE: When in Self-Test the "Check Engine" light will also flash the service codes.

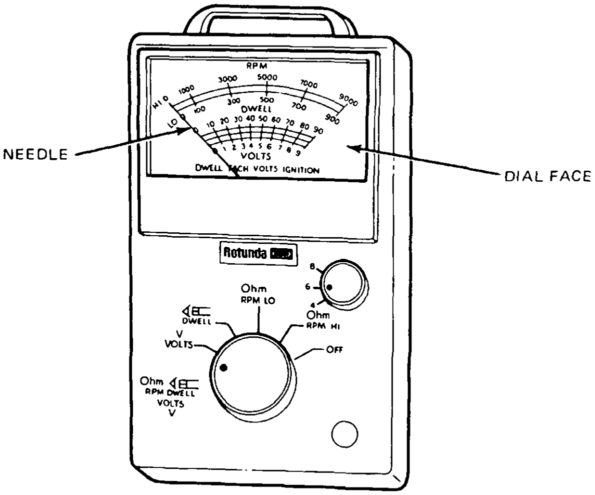
APPENDIX: Test Equipment

EQUIPMENT REQUIRED:

- Rotunda Self-Test Automatic Readout (STAR), No. 007-00004 with cable assembly No. 007-00010. Refer to STAR Tester operation.
- Analog volt-ohmmeter, 0 to 20v DC, (alternate to STAR).

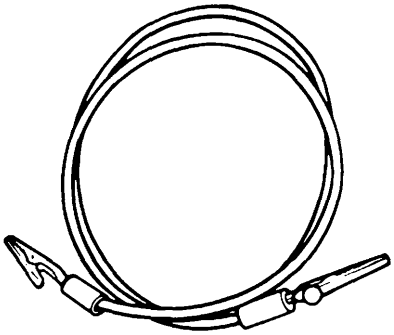


Automatic Readout (STAR) Tester

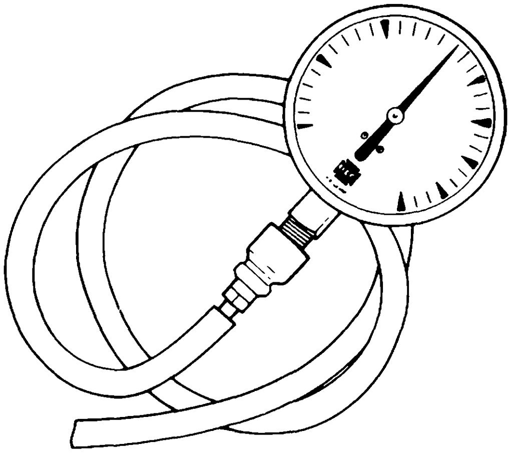


Analog Voltmeter

- Jumper wire.
- Vacuum gauge, Rotunda 059-00008 or equivalent. Range 0-30 in. Hg. Resolution 1 in. Hg.



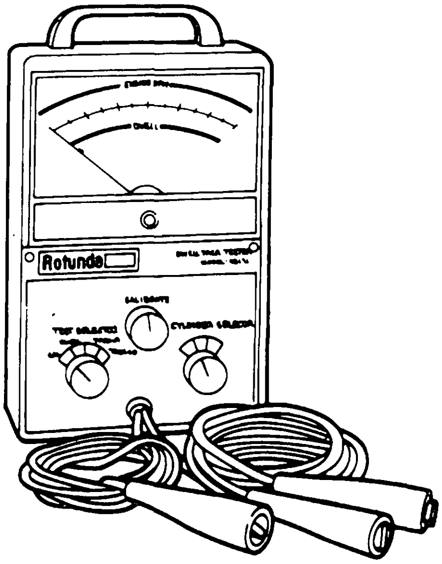
Jumper Wire



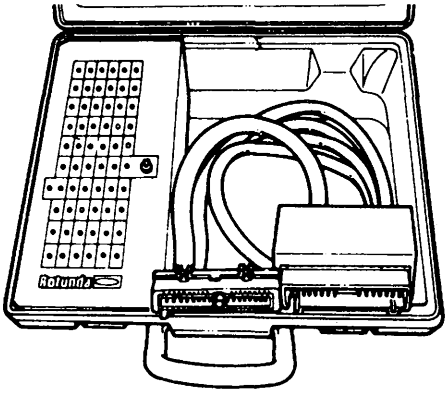
Vacuum Gauge

APPENDIX: Test Equipment (Continued)

- Tachometer, Rotunda No. 059-00010 or equivalent. Range 0-6,000 rpm. Accuracy ± 40 rpm. Resolution 20 rpm.
- Breakout Box, Rotunda 014-00322, Special Service Tool T83L-50-EEC-IV or equivalent.

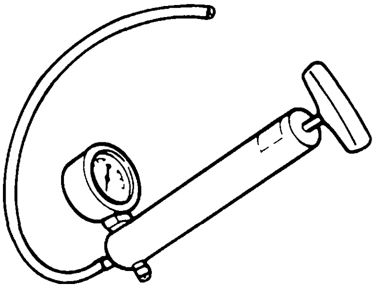


Tachometer

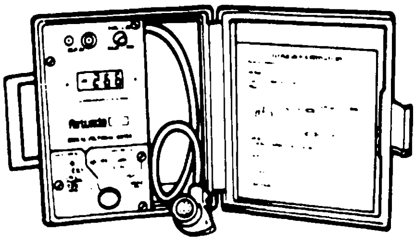


Breakout Box

- Vacuum pump, Rotunda No. 021-00014 or equivalent. Range 0-30 in. Hg.
- Digital volt-ohmmeter, Rotunda No. 014-00407 or equivalent. Input impedance 10 Megaohm minimum.



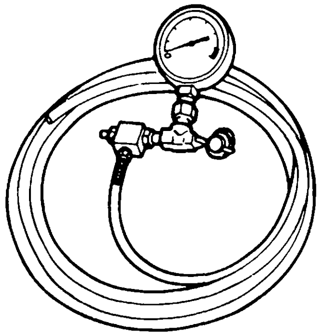
Vacuum Pump



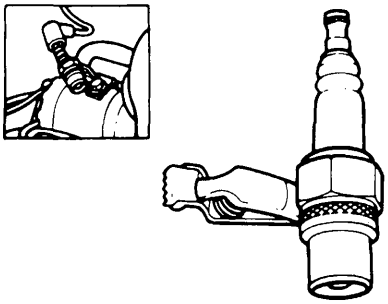
Digital Volt-Ohmmeter

APPENDIX: Test Equipment (Continued)

- Electronic Fuel Injection Pressure Gauge EFI/CFI only, Tool T80L-9974-A or equivalent. (Use instructions. For specific applications, refer to Shop Manual Group 24.)
- Spark tester (optional modified spark plug with side electrode removed). Tool D81P-6666-A or equivalent.

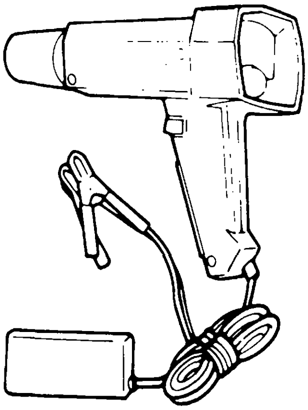


EFI Pressure Gauge

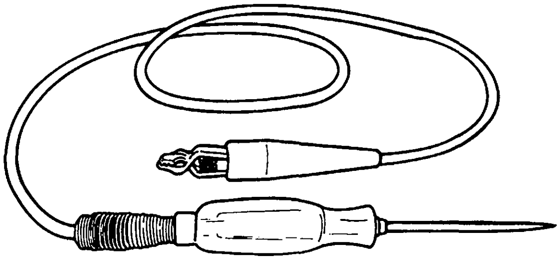


Spark Tester

- Timing light, Rotunda model 059-00006 or equivalent.
- Non-powered Test lamp.



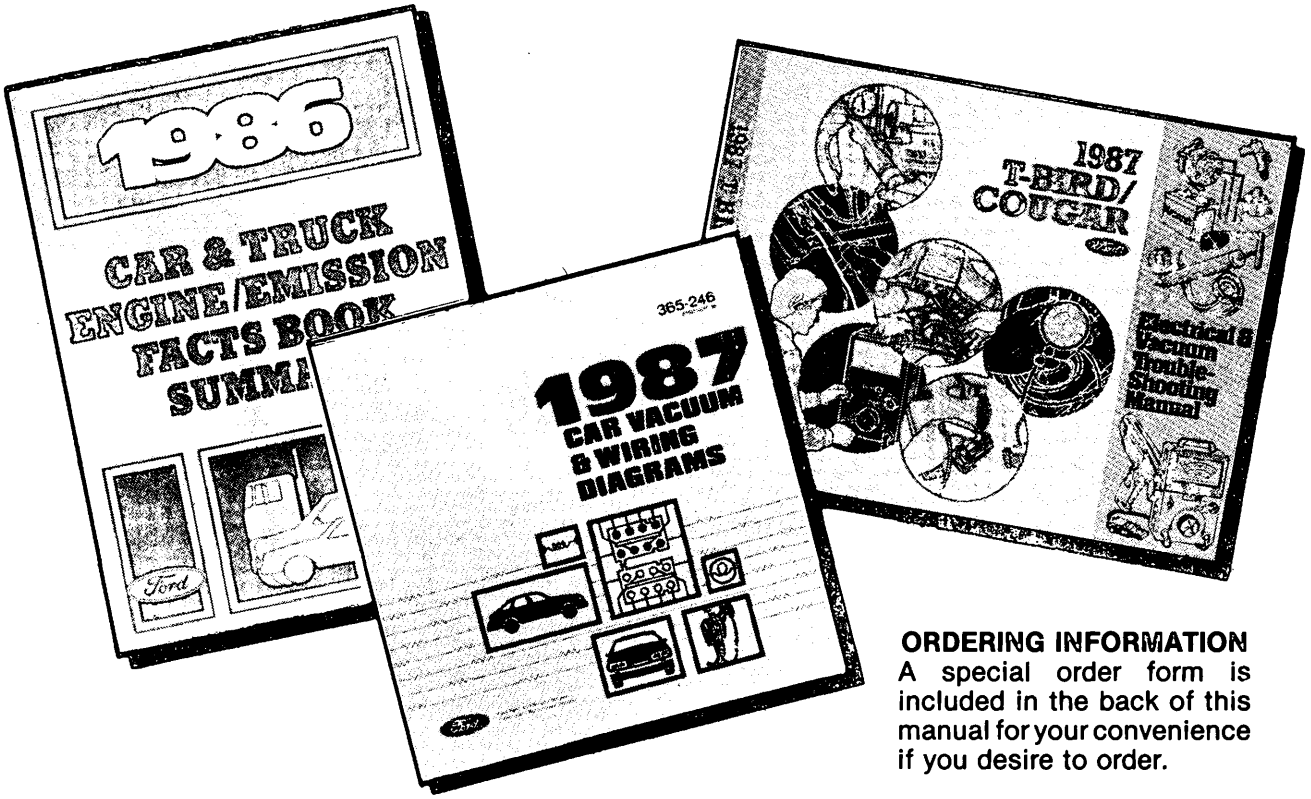
Timing Light



Non-Powered Test-Lamp

OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS


1986
CAR & TRUCK ENGINE/EMISSION FACTS BOOK SUMM
Ford
365-246
1987 CAR VACUUM & WIRING DIAGRAMS
1987 T-BIRD/COUGAR
Ford
Electrical & Vacuum Trouble-Shooting Manual

ORDERING INFORMATION
A special order form is included in the back of this manual for your convenience if you desire to order.

ENGINE EMISSIONS FACTS BOOK

- The manual contains complete specifications for each calibration number.
- Published at the conclusion of the model year.

ELECTRICAL & VACUUM TROUBLESHOOTING MANUAL (EVTM)

- Available for all passenger car and light truck vehicles, this publication provides schematics of all electrical and vacuum circuits. Wiring diagrams show how the circuit is powered. Troubleshooting hints are provided to point the technician in a general direction but are not step by step procedures.
- Available in the first quarter of the model year. (One manual for each passenger car and light truck family.)

WIRING & VACUUM DIAGRAMS

- This publication contains wiring diagrams for all Ford and Lincoln/Mercury passenger car and light truck vehicles. A Power Distribution system illustrates the power distribution throughout each vehicle. In addition, all individual electrical circuits are shown for each vehicle line.
- Available in the first quarter of the model year.

Service Specifications Manuals

(CAR AND TRUCK)

- These manuals contain all specifications including maintenance and lubrication contained in the Shop Manuals in a handy pocket size for easy reference.
- Available in the first quarter of the model year.

SECTION 17

EEC IV—Engine Supplement—Passenger Car

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EEC-IV Diagnostic By Symptom

1.9L CFI

SYMPTOM	RESULT	ACTION TO TAKE
• Engine runs rough or misfires. • Engine stalls. • Lack of power. • Rough idle.		• GO to Pinpoint Test Step S2. • GO to Pinpoint Test Step DF20. • EGR Valve Function. • Ignition system distributor cap, rotor, wires, coil, plugs. • Base engine valves, cam timing, compression etc. • Poor power/ground connections.
• Low idle with A/C on.		For A/T: • Place A/C switch to A/C. • Perform KOEO Quick Test. • If code 67 is present GO to FA1. • If code 67 is not present GO to Pinpoint Test Step FA20. For M/T: • GO to Pinpoint Test Step FA20.
• Stumble after hot restart (HEGO).		• GO to Pinpoint Test Step HF20.
• Shift indicator light always on or off.		GO to Pinpoint Test Step KL1.
• Gasoline fumes under hood.		GO to Pinpoint Test Step KD1.
• Stall during parking maneuvers.		GO to Pinpoint Test Step FF3.

CA9951-A

EEC-IV Diagnostic By Symptom-Continued

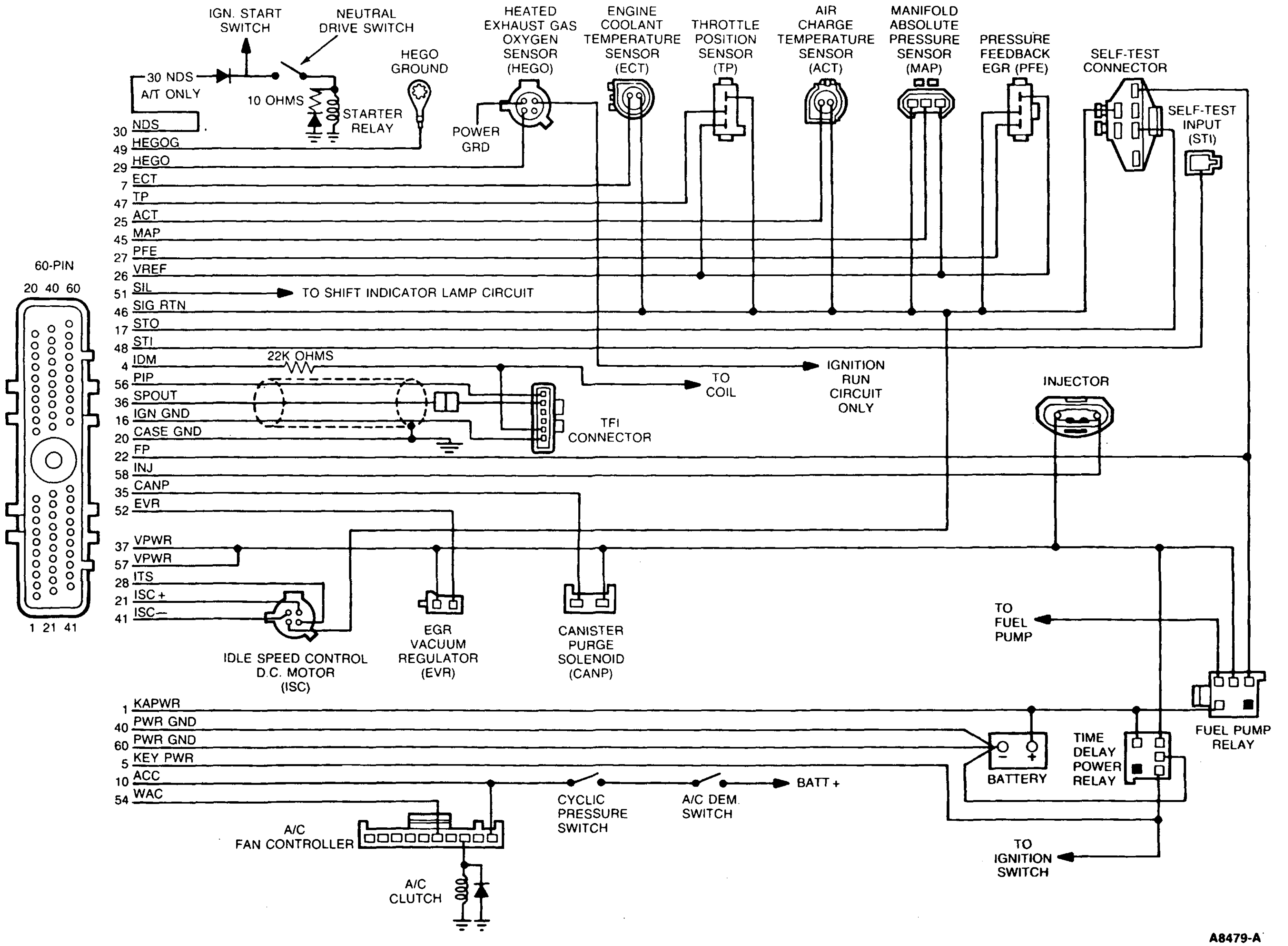
1.9L CFI

SYMPTOM	RESULT	ACTION TO TAKE
• High idle in Drive, automatic transmission only.		• Place transmission in Drive with engine off. Test neutral drive circuit (test Pin 30) for short to ground. SERVICE as necessary. NOTE: Circuit should NOT have continuity to ground in DRIVE.
• Fuel pump always runs.		GO to Pinpoint Test Step **J15**.
• A/C does not cut off under WOT conditions.		GO to Pinpoint Test Step **KM1**.

CA9952-A

Electrical Schematic

1.9L CFI



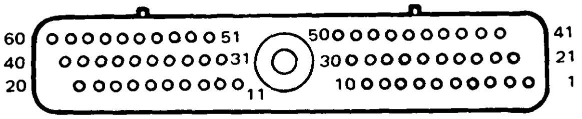
NOTE: WIRING SCHEMATIC SHOWS PIN OUT LOOKING INTO HARNESS CONNECTORS

EEC-IV Module Connector Pin Usage

1.9L CFI

Pin	Circuit	Wire Color	Application	Abbreviations
1	37	Y	Keep Alive Power	KAPWR
4	11	DG/Y	Ignition Diagnostic Monitor	IDM
5	16	R/LG	Key Power	KPWR
7	354	LG/Y	Engine Coolant Temperature Sensor	ECT
10	347	BK/Y	A/C Clutch Compressor Signal	ACCS
16	259	BK/O	Ignition Ground	IGN GND
17	201	T/R	Self-Test Output/Shift Indicator Light	STO/SIL
20	57	BK	Case Ground	CSE GND
21	376	BR/W	Idle Speed Control	ISC +
22	97	T/LG	Fuel Pump Relay	FP
25	357	LG/P	Air Charge Temperature Sensor	ACT
26	351	O/W	Reference Voltage	VREF
27	352	BR/LG	Pressure Feedback EGR	PFE
28	265	LG/W	Idle Tracking Switch	ITS
29	94	DG/P	Heated Exhaust Gas Oxygen Sensor	HEGO
30	614	GY/O	Neutral Drive Switch (A/T Only)	NDS
35	101	GY/Y	Canister Purge Solenoid	CANP
36	324	Y/LG	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
40	60	BK/LG	Power Ground	PWR GND
41	264	W/LB	Idle Speed Control	ISC –
45	358	LG/BK	Manifold Absolute Pressure Sensor	MAP
46	359	BK/W	Signal Return (Ground)	SIG RTN
47	355	DG/LG	Throttle Position Sensor	TP
48	100	W/R	Self-Test Input	STI
49	89	O	Heated Exhaust Gas Oxygen Ground	HEGOG
51	224	T/LB	Shift Indicator Light (M/T Only)	SIL
52	362	Y	EGR Valve Regulator Solenoid	EVR
54	73	O/LB	WOT A/C Cutoff	WAC
56	349	DB	Profile Ignition Pick-Up	PIP
57	361	R	Vehicle Power	VPWR
58	95	T/R	Fuel Injector	INJ
60	60	BK/LG	Power Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA9900-A

EEC-IV Diagnostic By Symptom

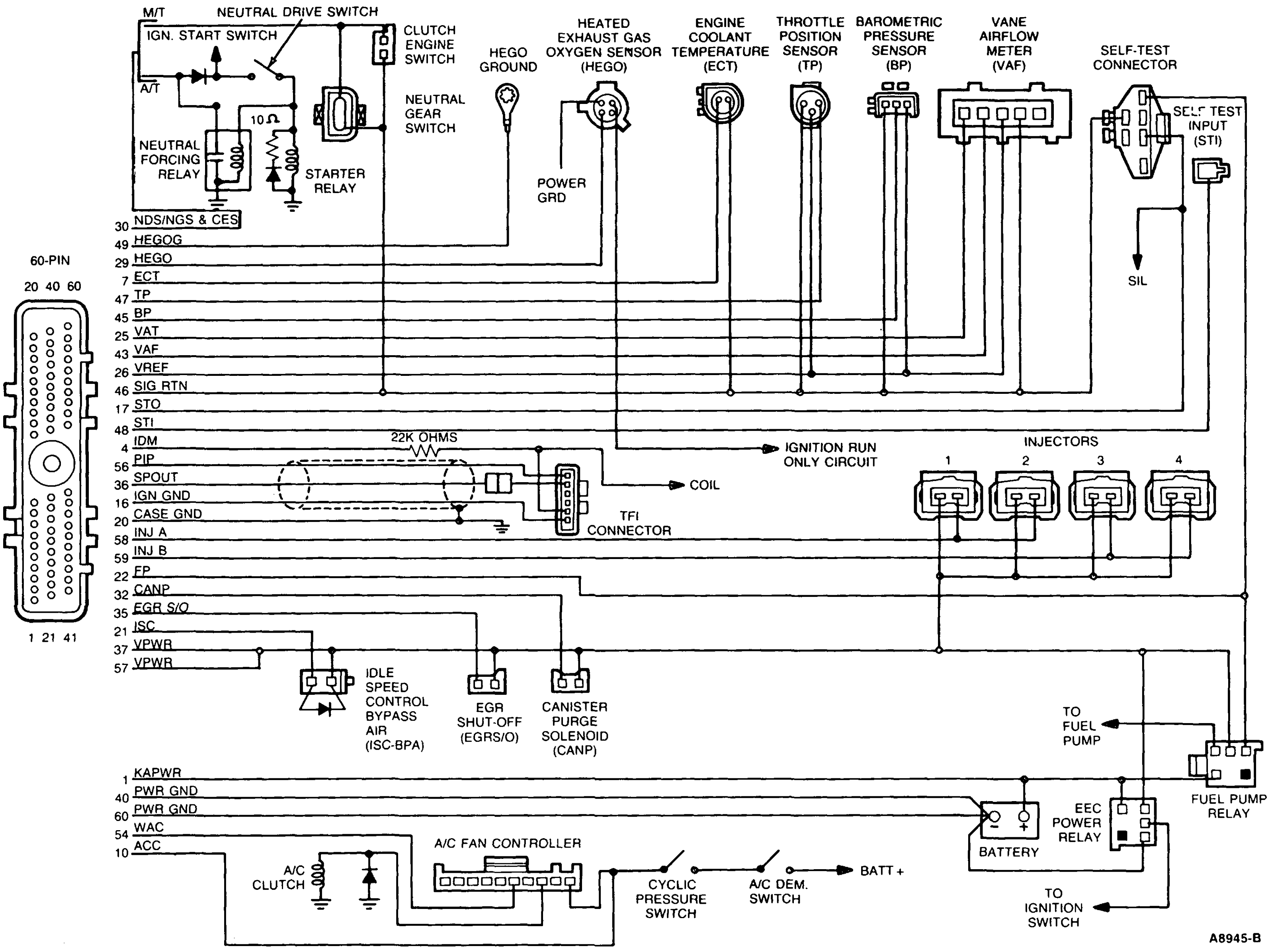
1.9L EFI

SYMPTOM	RESULT	ACTION TO TAKE
• Engine stalls. • Stalls in Self-Test. • Runs rough. • Misses. • Always Rich/Lean.		• GO to Pinpoint Test Step S1. • GO to Pinpoint Test Step DF20. • Poor power/ground connections. • Ignition system distributor cap, rotor, wires, coil, plugs. • Base engine valves, cam timing, compression etc.
• Stumble after hot restart.		GO to Pinpoint Test Step HA20.
• Fuel pump always runs.		GO to Pinpoint Test Step J15.
• Detonation/spark knock.		GO to Pinpoint Test Step KA1.
• High idle speeds on each restart may be accompanied by detonation for up to 3-5 minutes after a restart.		GO to Pinpoint Test Step KA1.
• Low engine rpm with A/C On.		GO to Pinpoint Test Step FA20.
• Gasoline fumes under hood.		GO to Pinpoint Test Step KD1.
• Shift indicator light always On or Off.		GO to Pinpoint Test Step KL1.
• A/C does not cut-off under WOT conditions.		GO to Pinpoint Test Step KM1.

CA9953-A

Electrical Schematic

1.9L EFI



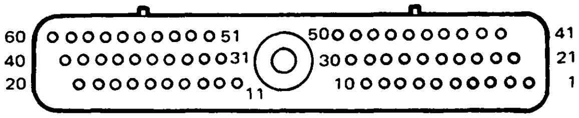
NOTE: WIRING SCHEMATIC SHOWS PIN OUT LOOKING INTO HARNESS CONNECTORS

EEC-IV Module Connector Pin Usage

1.9L EFI

Pin	Circuit	Wire Color	Application	Abbreviations
1	37A	Y	Keep Alive Power	KAPWR
4	11B	DG/Y	Ignition Diagnostic Monitor	IDM
7	354	LG/Y	Engine Coolant Temperature	ECT
10	347	BK/Y	A/C Clutch	ACCS
16	259	BK/O	Ignition Ground	IGN GND
17	201	T/R	Self-Test Output/Shift Indicator Light	STO/SIL
20	57	BK	Case Ground	CSE GND
21	68	O/BK	Idle Speed Control	ISC
22	97	T/LG	Fuel Pump	FP
25	357	LG/P	Vane Air Temperature	VAT
26	351	O/W	Reference Voltage	VREF
29	94	DG/P	Heated Exhaust Gas Oxygen Sensor	HEGO
30	614	GY/O	Neutral Drive Switch (A/T Only)	NDS
32	101	GY/Y	Canister Purge Solenoid	CANP
35	362	Y	Exhaust Gas Recirculation Shut Off	EGR S/O
36	324A	Y/LG	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
40	60A	BK/LG	Power Ground	PWR GND
43	200	W/BK	Vane Air Flow	VAF
45	358	LG/BK	Barometric Pressure	BP
46	359	BK/W	Signal Return	SIG RTN
47	355	DG/LG	Throttle Position Sensor	TP
48	100	W/R	Self-Test Input	STI
49	89	O	Heated Exhaust Gas Oxygen Ground	HEGOG
54	73	O/LB	Wide Open Throttle A/C Cut-Off	WAC
56	349	DB	Profile Ignition Pickup	PIP
57	361A	R	Vehicle Power	VPWR
58	95	T/R	Injector 1 (Bank 1)	INJ 1
59	96	T/O	Injector 2 (Bank 2)	INJ 2
60	60B	BK/LG	Power Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA8133-D

EEC-IV Diagnostic By Symptom

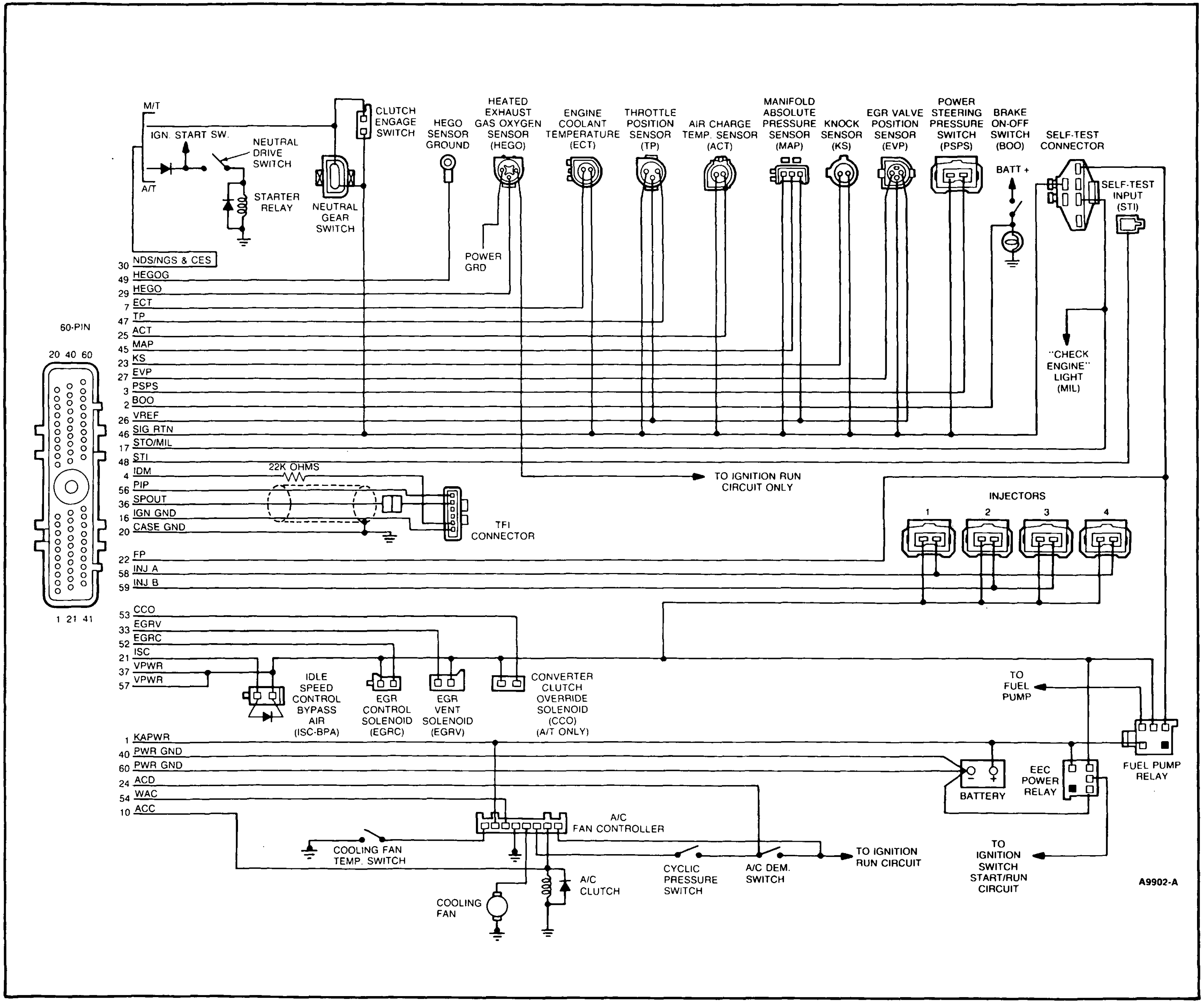
2.3L EFI

SYMPTOM	RESULT	ACTION TO TAKE
o Engine stalls. o Stalls in Self-Test. o Runs rough. o Misses. o Always rich/lean.		o GO to Pinpoint Test Step S1. o MAP test, GO to Pinpoint Test Step DF20. o Idle speed control, GO to Pinpoint Test Step KE1. o Poor power/ground connections. o Ignition system distributor cap, rotor, wires, coil, plugs. o Base engine valves, cam timing, compression etc.
o Detonation/spark knock.		GO to Pinpoint Test Step DG1 ,or EGR Diagnostic Section 6 of Volume H.
o A/C compressor runs continuously.		GO to Pinpoint Test Step FA4.
o Low idle during A/C On.		GO to Pinpoint Test Step FA20.
o "CHECK ENGINE" light always on.		GO to Pinpoint Test ML1.
o "CHECK ENGINE" light never on.		GO to Pinpoint Test ML5.
o A/C does not cut-off under WOT conditions. o A/C not functioning.		GO to Pinpoint Test Step KM1.
o Surges with A/C on at idle.		GO to Pinpoint Test Step KM20.
o Stumble after hot re-start (HEGO).		GO to Pinpoint Test Step HE21.
o Stall during parking maneuvers.		GO to Pinpoint Test Step FF3.
o Fuel pump runs with key off.		GO to Pinpoint Test Step J15.

CA9954-A

Electrical Schematic

2.3L EFI



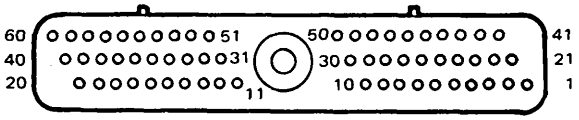
EEC-IV Module Connector Pin Usage

2.3L EFI

MUSTANG/CAPRI

Pin	Circuit	Wire Color	Application	Abbreviations
1	38	BK-O	Keep Alive Power	KAPWR
2	810	R-LG	Brake On/Off	BOO
3	330	Y-LG	Power Steering Pressure Switch	PSPS
4	11	DG-Y	Ignition Diagnostic Monitor	IDM
7	354	LG-Y	Engine Coolant Temperature	ECT
10	347	BK-Y	A/C Clutch	ACC
16	259	BK-O	Ignition Ground	IGN GND
17	657	T	Self-Test Output/"CHECK ENGINE" Light	STO/MIL
20	57	BK	Case Ground	CSE GND
21	264	W-LB	Idle Speed Control	ISC
22	97	T-LG	Fuel Pump	FP
23	310	Y-R	Knock Sensor	KS
24	348	LG-P	A/C Demand	ACD
25	357	LG-P	Air Charge Temperature	ACT
26	351	O-W	Reference Voltage	VREF
27	354	LG-Y	EGR Valve Position	EVP
29	94	DG-P	Heated Exhaust Gas Oxygen Sensor	HEGO
30	771	P-Y	Neutral Drive Switch (A/T Only)	NDS
30	771	P-Y	Neutral Gear Switch and Clutch Engage Switch (M/T)	NGS & CES
33	360	DG	Exhuast Gas Recirculation Vent	EGRV
36	324	Y-LG	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
40	60	BK-LG	Power Ground	PWR GND
45	358	LG-BK	Manifold Absolute Pressure	MAP
46	359	BK-W	Signal Return	SIG RTN
47	355	DG-LG	Throttle Position Sensor	TP
48	209	W-R	Self-Test Input	STI
49	89	O	Heated Exhaust Gas Oxygen Sensor Ground	HEGOG
52	362	Y	Exhaust Gas Recirculation Control	EGRC
53	237	O-Y	Clutch Converter Override (A/T only)	CCO
54	73	O-LB	W.O.T. A/C Cut Off	WAC
56	349	DB	Profile Ignition Pick-Up	PIP
57	361	R	Vehicle Power	VPWR
58	96	T-O	Injector 1 (Bank 1)	INJ 1
59	95	T-R	Injector 2 (Bank 2)	INJ 2
60	60	BK-LG	Power Ground	PWR GRD

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA9901-A

EEC-IV Diagnostic By Symptom

2.3L EFI TURBO

SYMPTOM	RESULT	ACTION TO TAKE
• Engine stalls. • Stalls in Self-Test. • Runs rough. • Misses.	• Always Rich/Lean. ▶	• GO to Pinpoint Test Step S1. • GO to Pinpoint Test Step DF20. • GO to Pinpoint Test Step KE1. • Poor power/ground connections. • Ignition system distributor cap, rotor, wires, coil, plugs. • Short to Ground, Go to Pinpoint Test Step J9. • Base engine valves cam timing, compression etc.
• Stumble after hot restart.		GO to Pinpoint Test Step HA20.
• "CHECK ENGINE" Light always on.		GO to Pinpoint Test Step ML1.
• "CHECK ENGINE" Light never on.		GO to Pinpoint Test Step ML5.
• Detonation/spark knock.		GO to Pinpoint Test Step DG1.
• High idle speeds on each restart may be accompanied by detonation for up to 3-5 minutes after a restart.		GO to Pinpoint Test Step DG1.
• Low engine rpm with A/C On.		GO to Pinpoint Test Step FA20.
• Gasoline fumes under hood.		GO to Pinpoint Test Step KD1.
• Shift indicator light always On or Off.		GO to Pinpoint Test Step KL1.
• Poor performance, sluggish detonation.	Boost control not functioning properly ▶	GO to Pinpoint Test Step KN1.

CA9955-A

EEC-IV Diagnostic By Symptom-Continued

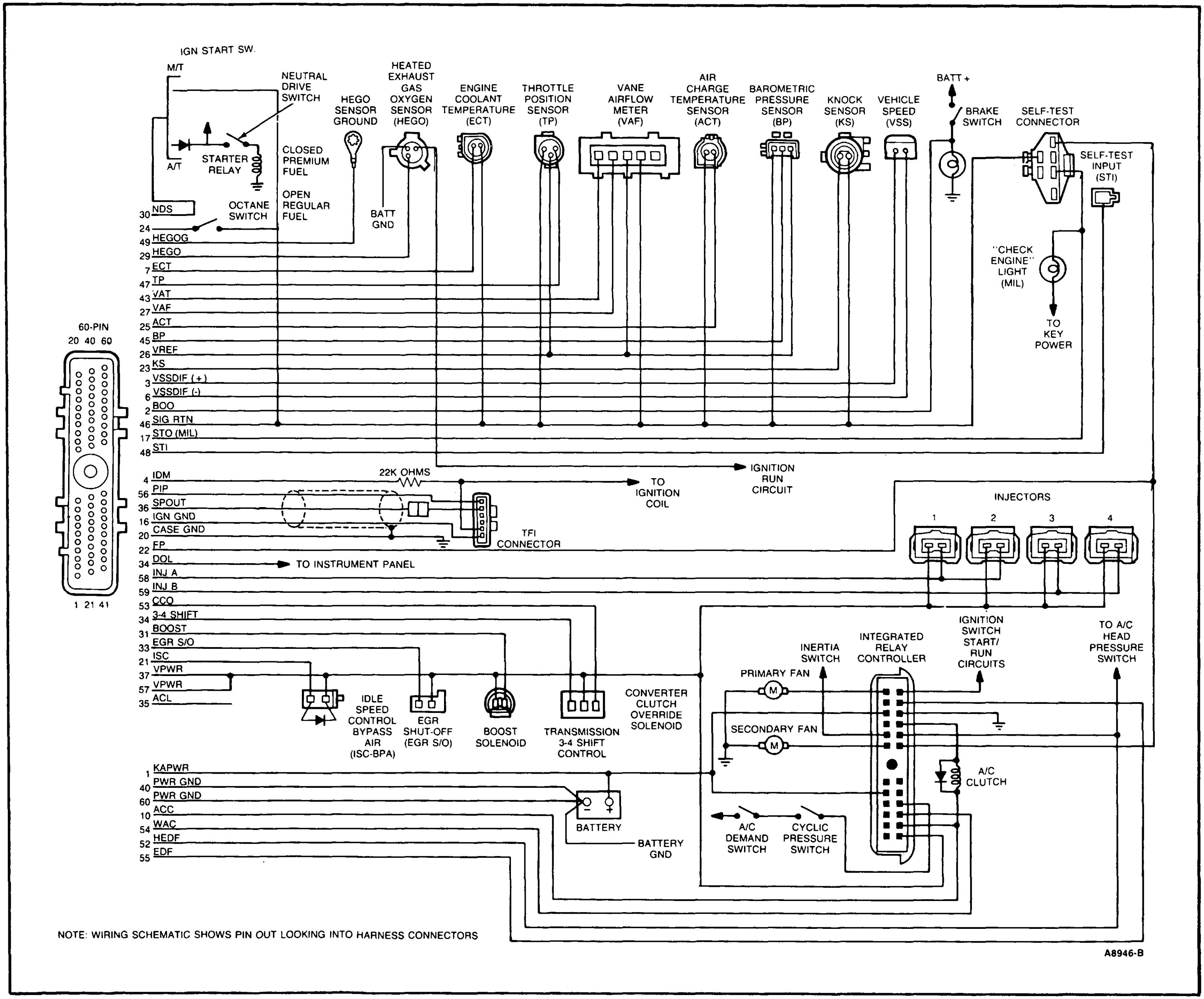
2.3L EFI TURBO

SYMPTOM	RESULT	ACTION TO TAKE
• Fuel pump always runs.		GO to Pinpoint Test Step $\boxed{X14}$.
• Primary fan or secondary fan always on.		GO to Pinpoint Test Step $\boxed{X35}$.
• No A/C.		GO to Pinpoint Test Step $\boxed{X50}$.
• No A/C cutout at WOT.		GO to Pinpoint Test Step $\boxed{X52}$.
• No primary or secondary fan.		GO to Pinpoint Test Step $\boxed{X70}$.

CA9956-A

Electrical Schematic

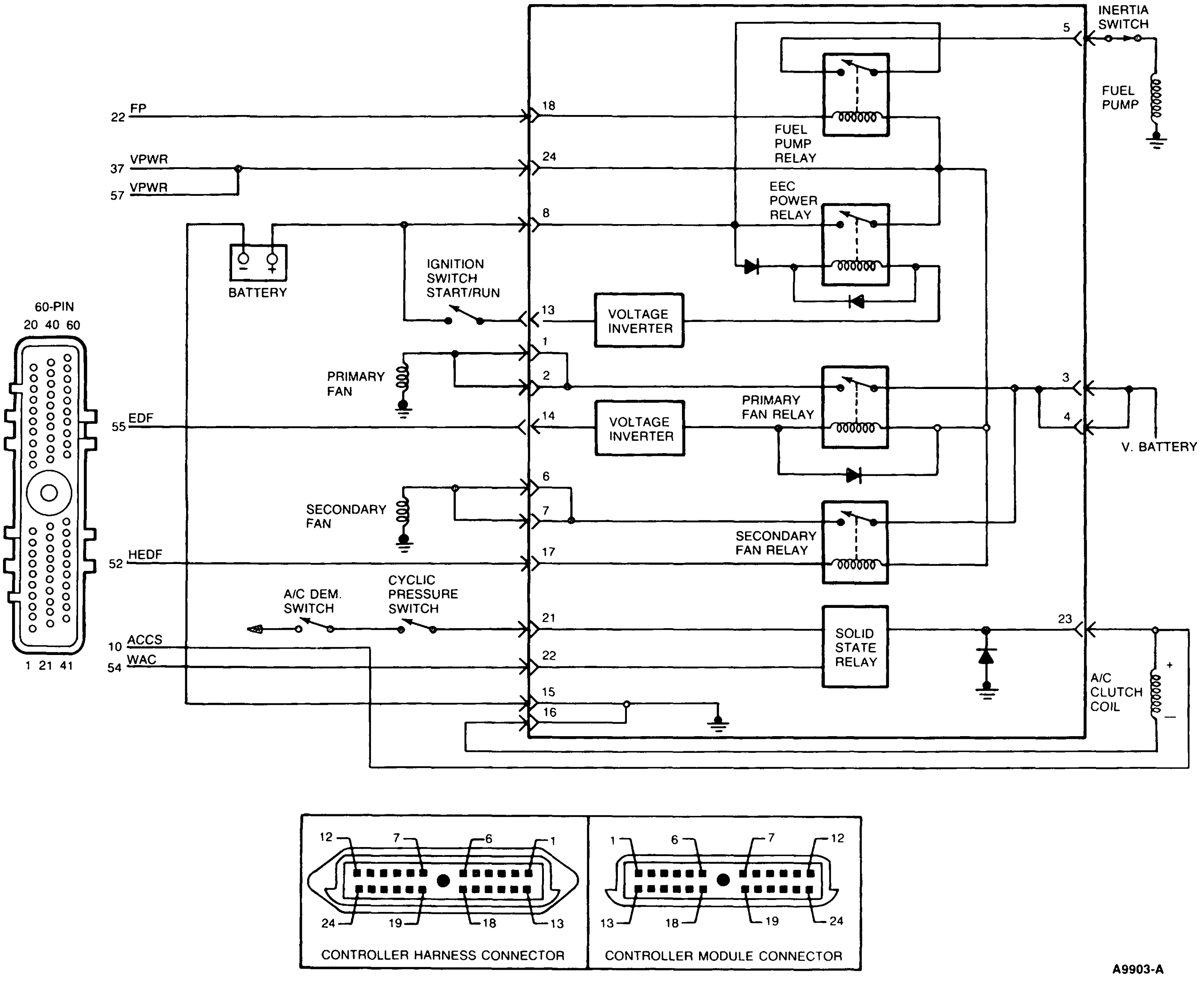
2.3L EFI TURBO



NOTE: WIRING SCHEMATIC SHOWS PIN OUT LOOKING INTO HARNESS CONNECTORS

Integrated Controller Schematic

2.3L EFI TURBO



Integrated Controller Usage Pin

2.3L EFI TURBO

Pin	Circuit	Wire Color	Applications	Abbreviations
1	228A	BR/Y	Power to Primary Fan	PTPF
2	228B	BR/Y	Power to Primary Fan	PTPF
3	37A	Y	Power to Primary and Secondary Relays	PTPSR
4	37B	Y	Power to Primary and Secondary Relays	PTPSR
5	787	PK/BK	Power to Fuel Pump	PTP
6	181A	BR/O	Power to Secondary Fan	PTSF
7	181B	BR/O	Power to Secondary Fan	PTSF
8	37C	Y	Battery to EEC Relay	BATT +
13	16C	R/LG	Key Power	KEY PWR
14	197	T/O	EDF Circuit (Primary)	EDF
15	60	BK/LG	Power Ground	PWR GRD –
16	321	GY/W	A/C Clutch Ground	PWR GRD
17	639	PK	HEDF Circuit (Secondary)	HEDF
18	97A	T/LG	Fuel Pump Circuit	FP
21	883	PK/LB	A/C Cyclic Switch	ACC
22	331	R	WOT A/C Cut Off Circuit	WAC
23	347B	BK/Y	Power to A/C	PTAC
24	361	R	Vehicle Power	VPWR

CA9904-A

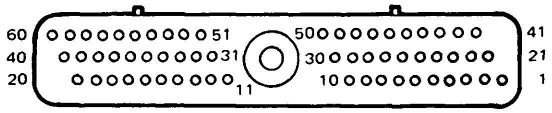
EEC-IV Module Connector Pin Usage

2.3L EFI TURBO

THUNDERBIRD

Pin	Circuit	Wire Color	Application	Abbreviations
1	37	Y	Keep Alive Power	KAPWR
2	511	LG	Brake On/Off	BOO
3	150	DG/W	Vehicle Speed Sensor +	VSS DIF +
4	11	DG/Y	Ignition Diagnostic Monitor	IDM
6	563	O/Y	Vehicle Speed Sensor −	VSS DIF −
7	354	LG/Y	Engine Coolant Temperature	ECT
10	347	BK/Y	A/C Clutch	ACC
16	259	BK/O	Ignition Ground	IGN GND
17	382	Y/BK	Self-Test Output/"CHECK ENGINE" Light	STO/(MIL)
20	60	BK/LG	Case Ground	CSE GND
21	68	O/BK	Idle Speed Control	ISC
22	97	T/LG	Fuel Pump Control	FP
23	310	Y/R	Knock Sensor	KS
24	670	R/Y	Octane Switch	OCTANE SW
25	470	P/BK	Air Charge Temperature Sensor	ACT
26	351	O/W	Voltage Reference	VREF
27	200	W/BK	Vane Air Flow	VAF
29	94	DG/P	Heated Exhaust Gas Oxygen Sensor	HEGO
30	376	BR/W	Neutral Drive Switch (A/T)	NDS
30	359	BK/W	Neutral Gear Switch and Clutch Engage Switch (M/T)	NGS and CES
31	464	BK/P	Boost Control	BOOST
33	362	Y	Exhaust Gas Recirculation Shut Off	EGR S/O
34	305	LB/P	Data Output Link	DOL
35	836	O/W	Automatic Adjustable Shock Controller	ACL
36	324	Y/LG	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
40	60	BK/LG	Battery Ground	PWR GND
43	357	LG/P	Vane Air Temperature	VAT
45	358	LG/BK	Barometric Pressure	BP
46	359	BK/W	Signal Return	SIG RTN
47	355	DG/LG	Throttle Position Sensor	TP
48	209	W/R	Self-Test Input	STI
49	89	O	Heated Exhaust Gas Oxygen Ground	HEGOG
52	639	P	High Electric Drive Fan	HEDF
54	331	R	W.O.T. A/C Cut-Off	WAC
55	197	T/O	Electric Drive Fan	EDF
56	349	DB	Profile Ignition Pick-Up	PIP
57	361	R	Vehicle Power	VPWR
58	95	T/R	Injector Bank A	INJ A
59	96	T/O	Injector Bank B	INJ B
60	60	BK/LG	Battery Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA8338-C

EEC-IV Diagnostic By Symptom

2.3L HSC-CFI

SYMPTOM	RESULT	ACTION TO TAKE
• Engine runs rough or misfires. • Engine stalls. • Lack of power. • Rough idle.		• GO to Pinpoint Test Step S2. • GO to Pinpoint Test Step DF20. • EGR Valve Function. • Ignition system distributor cap, rotor, wires, coil, plugs. • Base engine valves, cam timing, compression etc. • Poor power/ground connections.
• Low idle with A/C On.		• GO to Pinpoint Test Step FA20.
• Stumble after hot restart (HEGO).		• GO to Pinpoint Test Step HF20.
• Shift indicator light always on or off.		• GO to Pinpoint Test Step KL1.
• Stall during parking maneuvers.		• GO to Pinpoint Test Step FF3.

CA9957-A

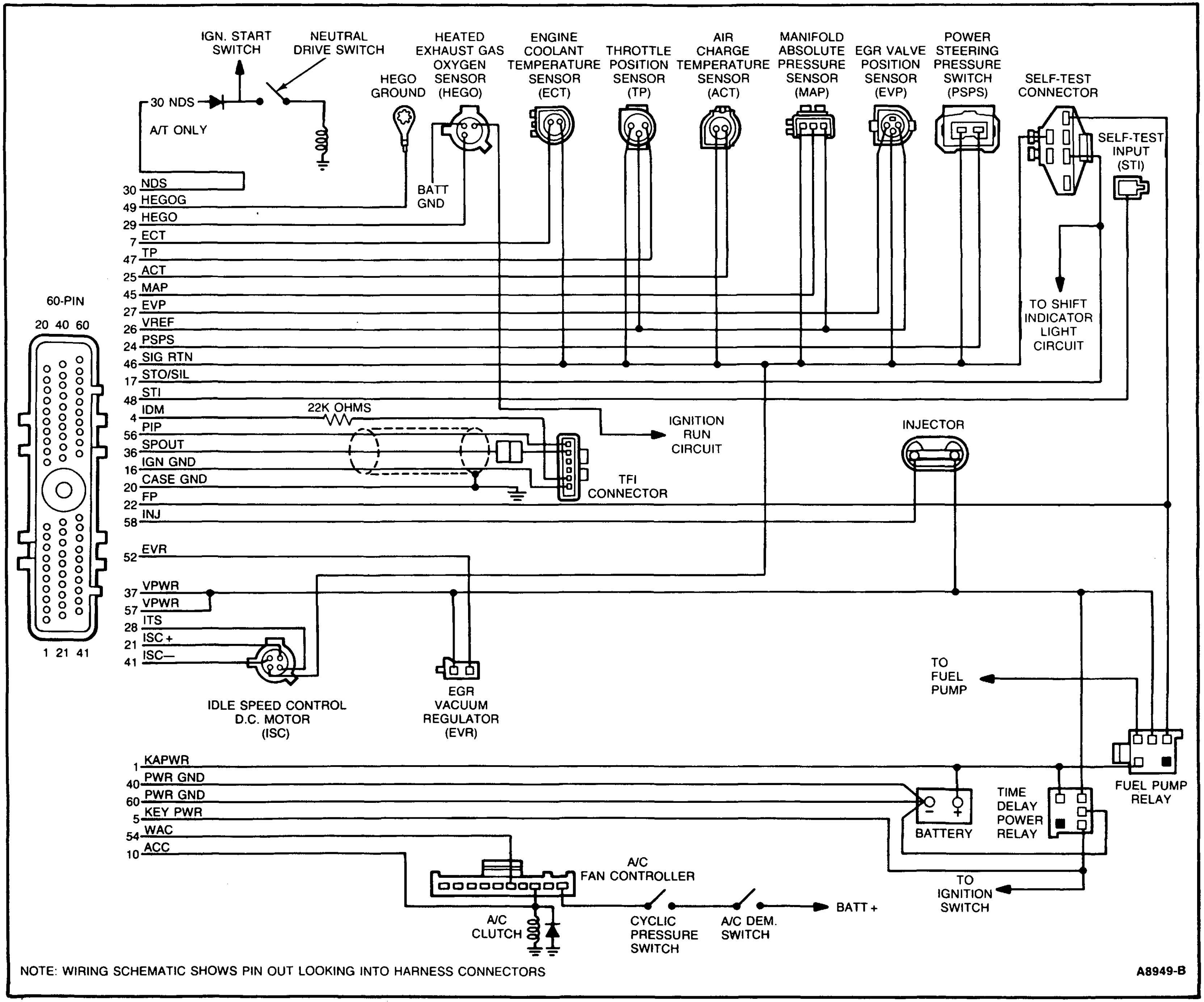
EEC-IV Diagnostic By Symptom-Continued

2.3L HSC-CFI

SYMPTOM	RESULT	ACTION TO TAKE
• High idle in Drive, automatic transmission only.		○ Place transmission in Drive with engine Off. Test neutral drive circuit (test Pin 30) for short to ground. SERVICE as necessary. **NOTE: Circuit should NOT have continuity to ground in Drive.**
• Fuel pump always runs.		○ GO to Pinpoint Test Step J15.
• A/C does not cutoff under WOT conditions. • No A/C.		○ GO to Pinpoint Test Step KM1.

CA9960-A

Electrical Schematic



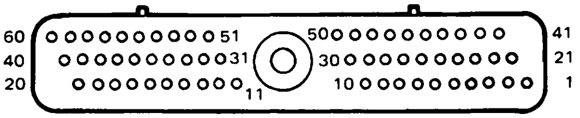
NOTE: WIRING SCHEMATIC SHOWS PIN OUT LOOKING INTO HARNESS CONNECTORS

EEC-IV Module Connector Pin Usage

2.3L HSC-CFI

Pin	Circuit	Wire Color	Application	Abbreviations
1	37	Y	Keep Alive Power	KAPWR
4	11	DG/Y	Ignition Diagnostic Monitor	IDM
5	20	W/LB	Key Power	KPWR
7	354	LG/Y	Engine Coolant Temperature Sensor	ECT
10	347	BK/Y	A/C Clutch Compressor Signal	ACC
16	259	BK/O	Ignition Ground	IGN GND
17	201	T/R	Self-Test Output/Shift Indicator Light	STO/SIL
20	57	BK	Case Ground	CASE GND
21	376	BR/W	Idle Speed Control +	ISC +
22	238	O/LB	Fuel Pump Relay	FP
24	330	Y/LG	Power Steering Pressure Switch	PSPS
25	357	LG/P	Air Charge Temperature Sensor	ACT
26	351	O/W	Reference Voltage	VREF
27	352	BR/LG	EGR Valve Position Sensor	EVP
28	265	LG/W	Idle Tracking Switch	ITS
29	94	DG/P	Heated Exhaust Gas Oxygen Sensor	HEGO
30	614	GY/O	Neutral Drive Switch (A/T Only)	NDS
36	324	Y/LG	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
40	60	BK/LG	Power Ground	PWR GND
41	264	W/LB	Idle Speed Control	ISC –
45	358	LG-BK	Manifold Absolute Pressure Sensor	MAP
46	359	BK/W	Signal Return (Ground)	SIG RTN
47	355	DG/LG	Throttle Position Sensor	TP
48	209	W/R	Self-Test Input	STI
49	89	O	Heated Exhaust Gas Oxygen Ground	HEGOG
52	362	Y	EGR Vacuum Regulator Solenoid	EVR
54	73	O/LB	WOT A/C Cutoff	WAC
56	349	DB	Profile Ignition Pick-Up	PIP
57	361	R	Vehicle Power	VPWR
58	95	T/R	Fuel Injector	INJ
60	60	BK/LG	Power Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA8340-C

EEC-IV Diagnostic By Symptom

2.5L CFI CLC, MTX

SYMPTOM	RESULT	ACTION TO TAKE
• Engine runs rough or miss-fires. • Engine stalls. • Lack of power. • Rough idle.		• GO to Pinpoint Test Step S2. • GO to map Pinpoint Test Step DF20. • EGR value function. • Ignition system distributor cap, rotor, wires, coil, plugs. • Base engine valves, cam timing, compression etc. • Poor power/ground connections.
• Low idle with A/C On.		• Place A/C switch to A/C. • Perform KOEO Self Test. • If code 67 is present GO to KF9. • If code 67 is not present GO to FA20.
• Gasoline fumes under hood.		• GO to Pinpoint Test Step KD1.
• Stalls during parking maneuvers.		• GO to Pinpoint Test Step FF3.
• High idle in Drive, automatic transmission only.		• Place transmission in Drive with engine Off. Test neutral drive circuit (test Pin 30) for short to ground. SERVICE as necessary. **NOTE: Circuit should NOT have continuity to ground in Drive.**
• Stumble after hot restart (HEGO).		• GO to Pinpoint Test Step HF20.

CA9958-A

EEC-IV Diagnostic By Symptom-Continued

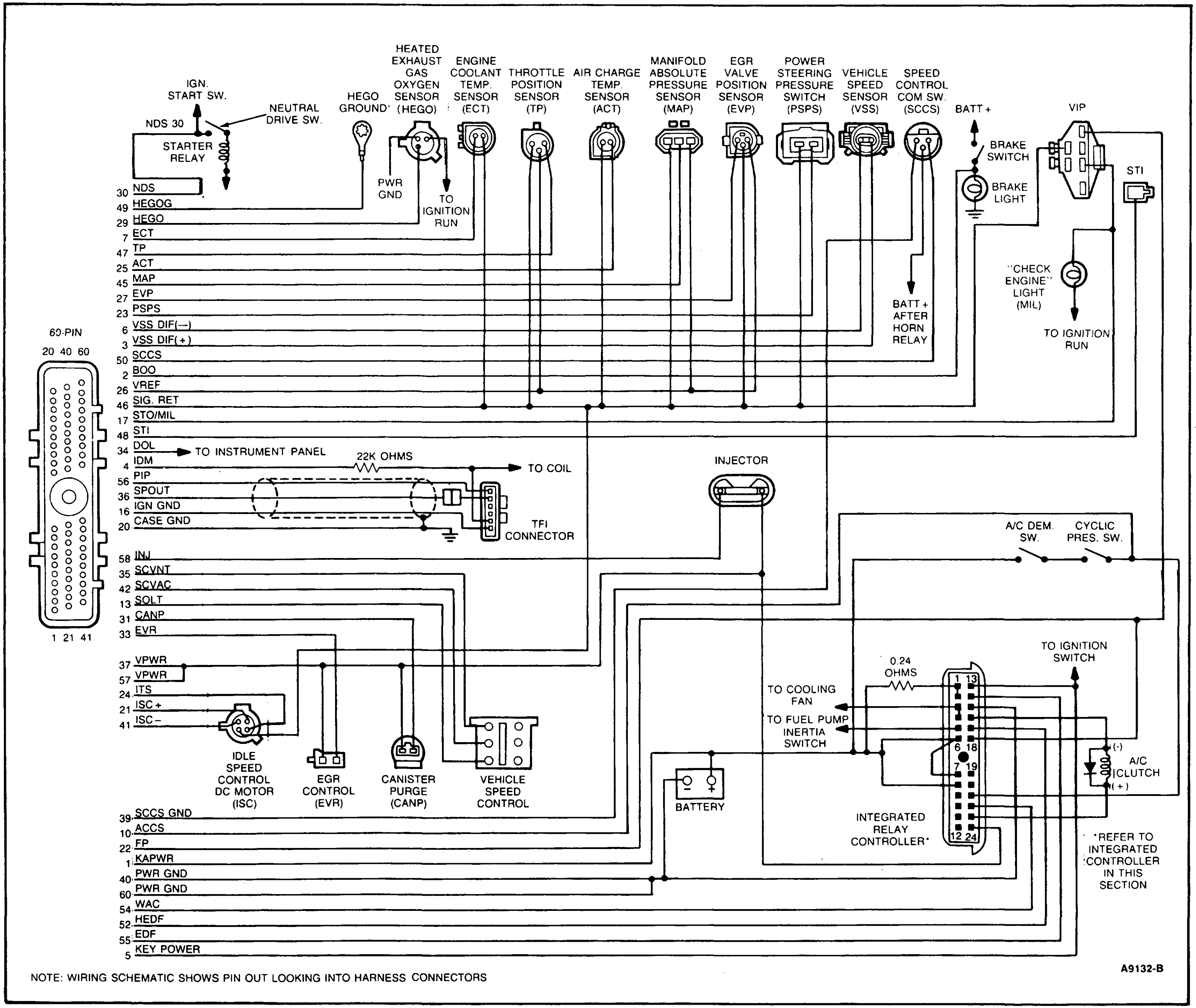
2.5L CFI
CLC,
MTX

SYMPTOM	RESULT	ACTION TO TAKE
• Shift indicator light always on or off.		• GO to Pinpoint Test Step KL1.
• "CHECK ENGINE" light always on.		• GO to Pinpoint Test Step ML1.
• "CHECK ENGINE" light never on.		• GO to Pinpoint Test Step ML5.
• Fuel pump always runs.		• Go to Pinpoint Test X-14.
• No cooling fan (MTX only).		• GO to Pinpoint Test X-40.
• No engine cooling fan (CLC only). • No low speed engine cooling fan (CLC only). • No high speed engine cooling fan (CLC only).		• GO to Pinpoint Test X-20.
• Low speed or high speed engine cooling fan on all the time (CLC only).		• GO to Pinpoint Test X-35.
• No A/C.		• GO to Pinpoint Test X-50.
• No A/C cut out at WOT.		• GO to Pinpoint Test X-52.

CA9959-A

Electrical Schematic

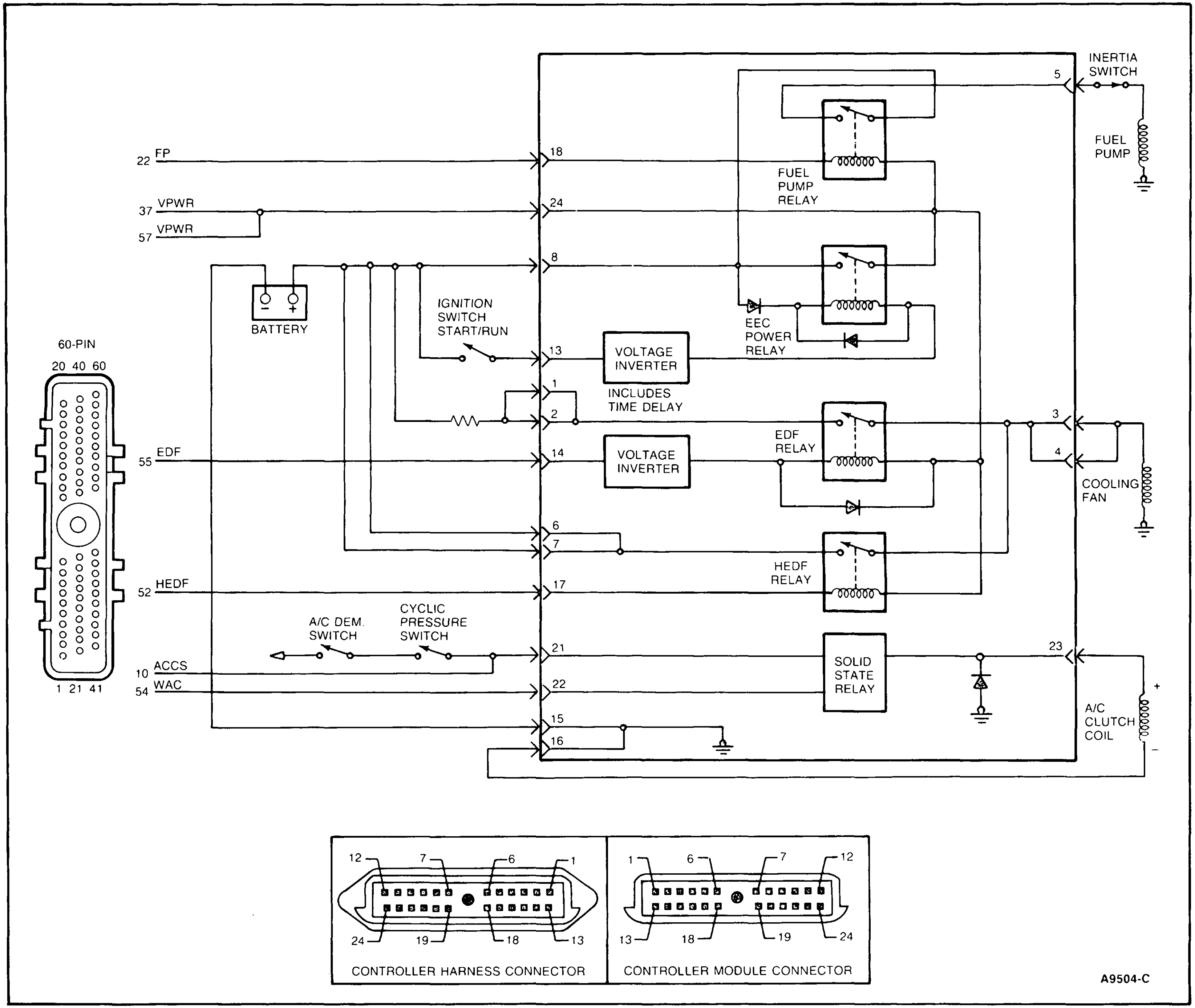
2.5L CFI CLC



NOTE: WIRING SCHEMATIC SHOWS PIN OUT LOOKING INTO HARNESS CONNECTORS

Integrated Controller Schematic

2.5L CFI CLC



Integrated Controller Usage Pin

2.5L CFI CLC

Pin	Circuit	Color	Application	Abbreviations
1	181	BR-O	EDF Power Into Controller	Batt +
2	181	BR-O	EDF Power Into Controller	Batt +
3	228	BR-Y	H/EDF Power to Fan	PTF
4	228	BR-Y	H/EDF Power to Fan	PTF
5	787	PK-BK	Power to the Pump	PTP
6	38	BK-O	HEDF Power Into Controller	Batt +
7	38	BK-O	HEDF Power Into Controller	Batt +
8	37	Y	Battery Voltage (Power Relay)	Batt +
9	—	—	Not Used	—
10	—	—	Not Used	—
11	—	—	Not Used	—
12	—	—	Not Used	—
13	16	R-LG	Keypower	KPWR
14	197	T-O	EDF Ground	EDF
15	60	BK-LG	Vehicle Ground	PWR GND
16	57	BK	A/C Ground	A/C GND
17	639	PK	HEDF Ground	HEDF
18	97	T-LG	Fuel Pump Relay Ground	FP
19	—	—	Not Used	—
20	—	—	Not Used	—
21	883	PK-LB	A/C Power In	ACCS
22	331	R	WOT A/C Cutoff	WAC
23	347	BK-Y	A/C Power to Clutch Coil	PTAC
24	361	R	EEC IV Power Out	VPWR

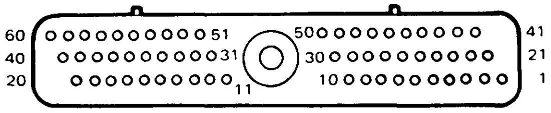
CA9905-A

EEC-IV Module Connector Pin Usage

2.5L CFI CLC

Pin	Circuit	Wire Color	Application	Abbreviations
1	37	Y	Keep Alive Power	KAPWR
2	810	R/LG	Brake On/Off	BOO
3	150	DG/W	Vehicle Speed Sensor +	VSS DIF +
4	11	DG/Y	Ignition Diagnostic Monitor	IDM
5	16	R/LG	Key Power	KPWR
6	563	O/Y	Vehicle Speed Sensor —	VSS DIF −
7	354	LG/Y	Engine Coolant Temperature	ECT
10	883	PK/LB	A/C Cycling Switch	ACCS
13	144	O/Y	Vehicle Speed Control Solenoid	SOL +
16	259	BK/O	Ignition Ground	IGN GND
17	201	T/R	Self-Test Out/"CHECK ENGINE" Light	STO/MIL
20	57	BK	Case Ground	CSE GND
21	382	Y/BK	Idle Speed Control (DC Motor)	ISC +
22	97	T/LG	Fuel Pump	FP
23	330	Y/LG	Power Steering Pressure Switch	PSPS
24	209	W/R	Idle Tracking Switch	ITS
25	357	LG/P	Air Charge Temperature	ACT
26	351	O/W	Reference Voltage	VREF
27	352	BR/LG	EGR Valve Position	EVP
29	94	DG/P	Heated Exhaust Gas Oxygen (Sensor)	HEGO
30	199	LB/Y	Neutral Drive Switch	NDS
31	101	GY/Y	Canister Purge Solenoid	CANP
33	360	DG	EGR Vacuum Regulator (Solenoid)	EVR
34	305	LB/PK	Data Output Link	DOL
35	146	W PK	Speed Control Vent (Solenoid)	SCVNT
36	324	Y/LG	Spark Out	SPOUT
37	361	R	Vehicle Power	VPWR
39	461	O	Speed Control Command Switch Ground	SCCS GND
40	60	BK/LG	Power Ground	PWR GND
41	377	W	Idle Speed Control — (DC Motor)	ISC −
42	145	GY/BK	Speed Control Vacuum (Solenoid)	SCVAC
45	358	LG/BK	Manifold Absolute Pressure (Sensor)	MAP
46	359	BK/W	Signal Return (Ground)	SIG RTN
47	355	DG/LG	Throttle Position (Sensor)	TP
48	200	W/BK	Self-Test Input	STI
49	89	O	Heated Exhaust Gas Oxygen (Sensor) Ground	HEGO GND
50	151	LB/BK	Speed Control Command Switch	SCCS
52	639	PK	High Electro Drive Fan	HEDF
54	331	R	Wide Open Throttle (WOT) A/C Cutoff	WAC
55	197	T/O	Electro Drive Fan (Low)	EDF
56	349	DB	Profile Ignition Pick-up	PIP
57	361	R	Vehicle Power	VPWR
58	95	T/R	Injector	INJ
60	60	BK/LG	Power Ground	PWR GND

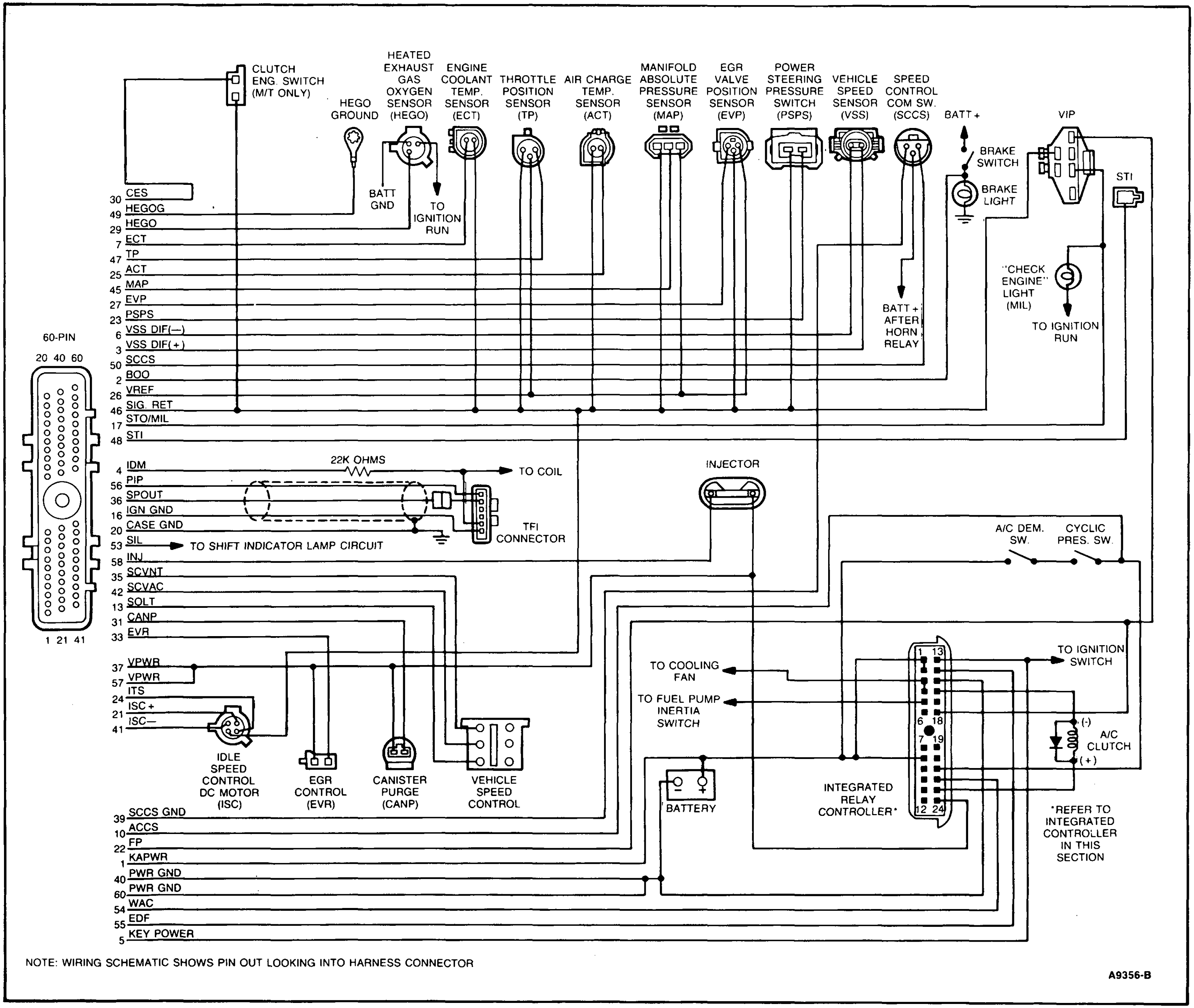
Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA9377-B

Electrical Schematic

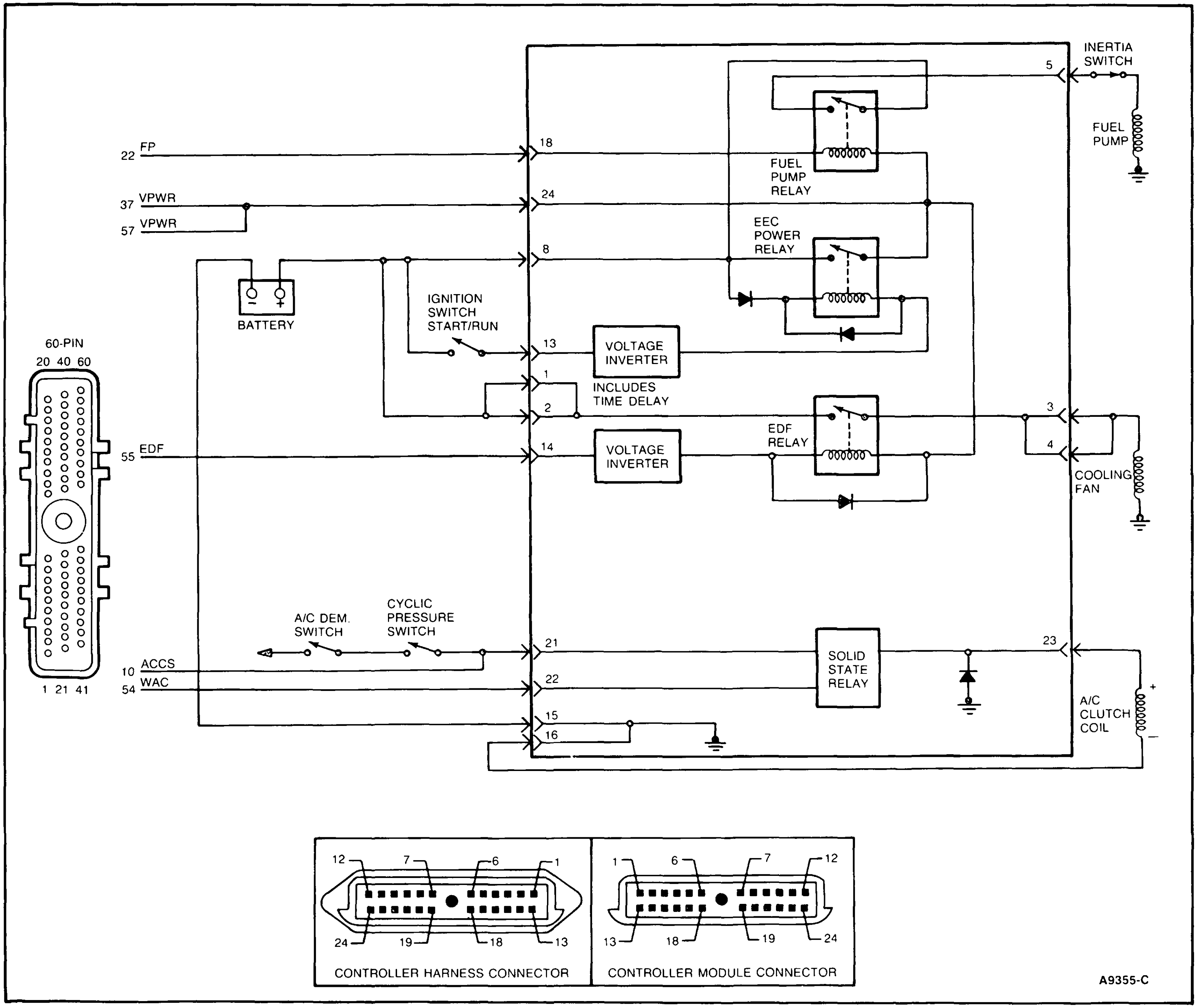
2.5L CFI MTX



NOTE: WIRING SCHEMATIC SHOWS PIN OUT LOOKING INTO HARNESS CONNECTOR

Integrated Controller Schematic

2.5L CFI MTX



Integrated Controller Usage Pin

2.5L CFI MTX

Pin	Circuit	Color	Application	Abbreviations
1	181	BR-O	EDF Power Into Controller	Batt +
2	181	BR-O	EDF Power Into Controller	Batt +
3	228	BR-Y	H/EDF Power to Fan	PTF
4	228	BR-Y	H/EDF Power to Fan	PTF
5	787	PK-BK	Power to the Pump	PTP
6	—	—	Not Used	—
7	—	—	Not Used	—
8	37	Y	Battery Voltage (Power Relay)	Batt +
9	—	—	Not Used	—
10	—	—	Not Used	—
11	—	—	Not Used	—
12	—	—	Not Used	—
13	16	R-LG	Keypower	KPWR
14	197	T-O	EDF Ground	EDF
15	60	BK-LG	Vehicle Ground	PWR GND
16	57	BK	A/C Ground	A/C GND
17	—	—	Not Used	—
18	97	T-LG	Fuel Pump Relay Ground	FP
19	—	—	Not Used	—
20	—	—	Not Used	—
21	883	PK-LB	A/C Power In	ACCS
22	331	R	WOT A/C Cutoff	WAC
23	347	BK-Y	A/C Power to Clutch Coil	PTAC
24	361	R	EEC IV Power Out	VPWR

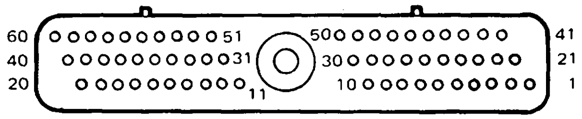
CA9906-A

EEC-IV Module Connector Pin Usage

2.5L CFI MTX

Pin	Circuit	Wire Color	Application	Abbreviations
1	37	Y	Keep Alive Power	KA PWR
2	810	R/LG	Brake On/Off	BOO
3	150	DG/W	Vehicle Speed Sensor +	VSS DIF +
4	11	DG/Y	Ignition Diagnostic Monitor	IDM
5	16	R/LG	Key Power	KPWR
6	563	O/Y	Vehicle Speed Sensor —	VSS DIF –
7	354	LG/Y	Engine Coolant Temperature	ECT
10	883	PK/LB	A/C Cycling Switch	ACCS
13	144	O/Y	Vehicle Speed Control Solenoid	SOL +
16	259	BK/O	Ignition Ground	IGN GND
17	201	T/R	Self-Test Out/"CHECK ENGINE" Light	STO/MIL
20	57	BK	Case Ground	CSE GND
21	382	Y/BK	Idle Speed Control (DC Motor)	ISC +
22	97	T/LG	Fuel Pump	FP
23	330	Y/LG	Power Steering Pressure Switch	PSPS
24	209	W/R	Idle Tracking Switch	ITS
25	357	LG/P	Air Charge Temperature	ACT
26	351	O/W	Reference Voltage	VREF
27	352	BR/LG	EGR Valve Position	EVP
29	94	DG/P	Heated Exhaust Gas Oxygen (Sensor)	HEGO
30	480	P/Y	Clutch Engage Switch	CES
31	101	GY/Y	Canister Purge Solenoid	CANP
33	360	DG	EGR Vacuum Regulator (Solenoid)	EVR
35	146	W PK	Speed Control Vent (Solenoid)	SCVNT
36	324	Y/LG	Spark Out	SPOUT
37	361	R	Vehicle Power	VPWR
39	461	O	Speed Control Command Switch Ground	SCCS GND
40	60	BK/LG	Power Ground	PWR GND
41	377	W	Idle Speed Control — (DC Motor)	ISC –
42	145	GY/BK	Speed Control Vacuum (Solenoid)	SCVAC
45	358	LG/BK	Manifold Absolute Pressure (Sensor)	MAP
46	359	BK/W	Signal Return (Ground)	SIG RTN
47	355	DG/LG	Throttle Position (Sensor)	TP
48	200	W/BK	Self-Test Input	STI
49	89	O	Heated Exhaust Gas Oxygen (Sensor) Ground	HEGO GND
50	151	LB/BK	Speed Control Command Switch	SCCS
53	462	P	Shift Indicator Light	SIL
54	331	R	Wide Open Throttle (WOT) A/C cutoff	WAC
55	197	T/O	Electro Drive Fan	EDF
56	349	DB	Profile Ignition Pick-Up	PIP
57	361	R	Vehicle Power	VPWR
58	95	T/R	Injector	INJ
60	60	BK/LG	Power Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA9378-B

EEC-IV Diagnostic By Symptom

3.0L EFI

SYMPTOM	RESULT	ACTION TO TAKE
• Engine runs rough or miss-fires. • Engine stalls. • Rough idle.		• GO to Pinpoint Test Step **S1**. • GO to map Pinpoint Test Step **DF20**. • EGR value function. • Ignition system distributor cap, rotor, wires, coil, plugs. • Base engine valves cam timing, compression etc. • Fuel delivery. • Poor power/ground connections.
• Detonation/spark knock.		GO to Pinpoint Test Step **DG1**.
• Stalls during parking maneuvers.		GO to Pinpoint Test Step **FF3**.
• Gasoline fumes under hood.		GO to Pinpoint Test Step **KD1**.
• Noise emitting from rear of vehicle with Key Off.	Fuel pump always on.	GO to Pinpoint Test Step **X-14**.
• No engine cooling fan. • No low speed engine cooling fan. • No high speed engine cooling fan.		GO to Pinpoint Test Step **X-20**.
• Low speed or high speed engine cooling fan on all the time.		GO to Pinpoint Test Step **X-35**.
• Stumble after hot restart (HEGO).		GO to Pinpoint Test Step **HG-21**.
• No A/C.		GO to Pinpoint Test **X-50**.
• No A/C cut out at WOT.		GO to Pinpoint Test **X-52**.
• Low idle rpm during A/C On.		GO to Pinpoint Test Step **FA20**.

CA9961-A

EEC-IV Diagnostic By Symptom-Continued

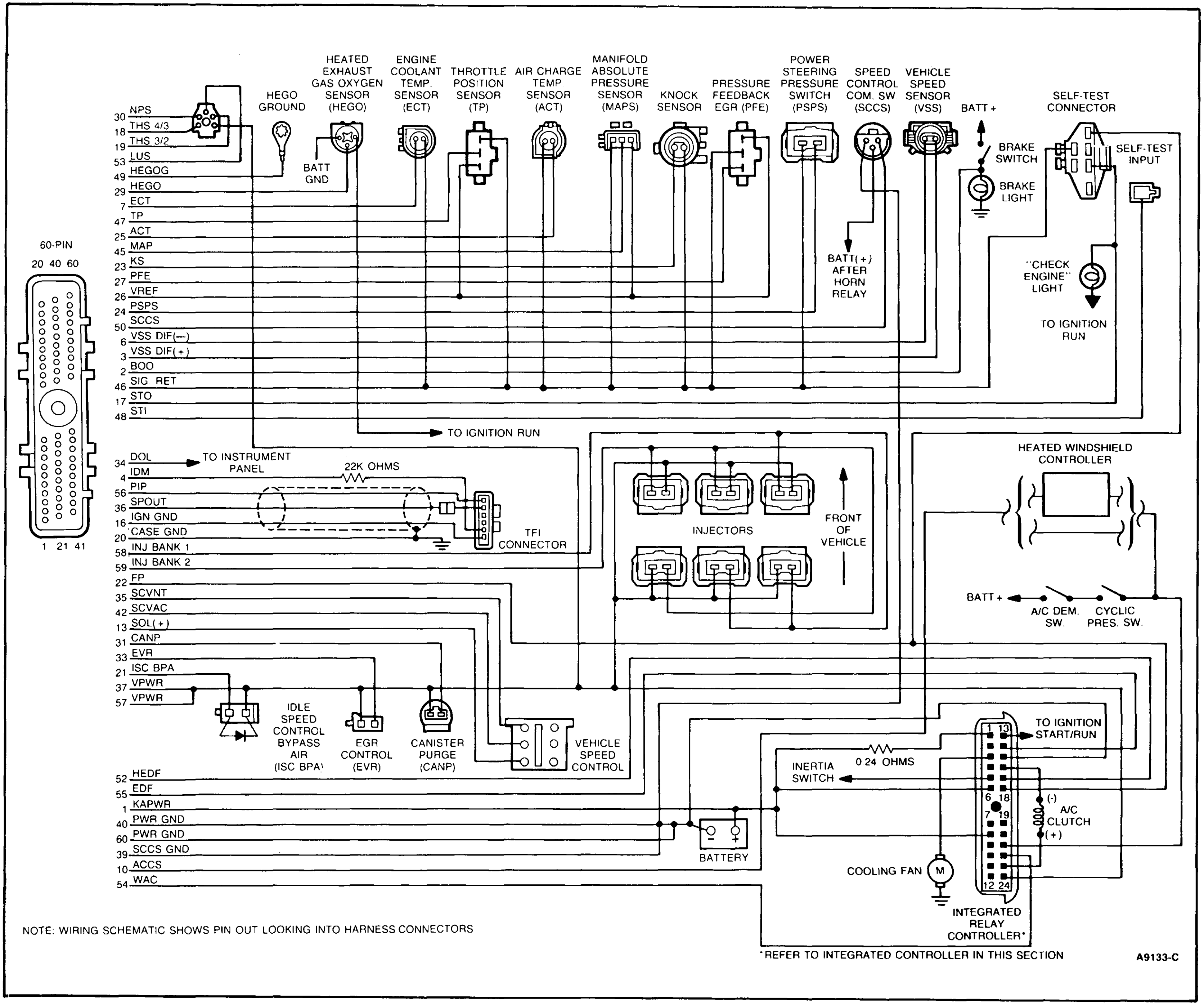
3.0L EFI

SYMPTOM	RESULT	ACTION TO TAKE
o "CHECK ENGINE" light always on.		o GO to Pinpoint Test Step ML1.
o "CHECK ENGINE" light never on.		o GO to Pinpoint Test ML5.

CA9962-A

Electrical Schematic

3.0L EFI



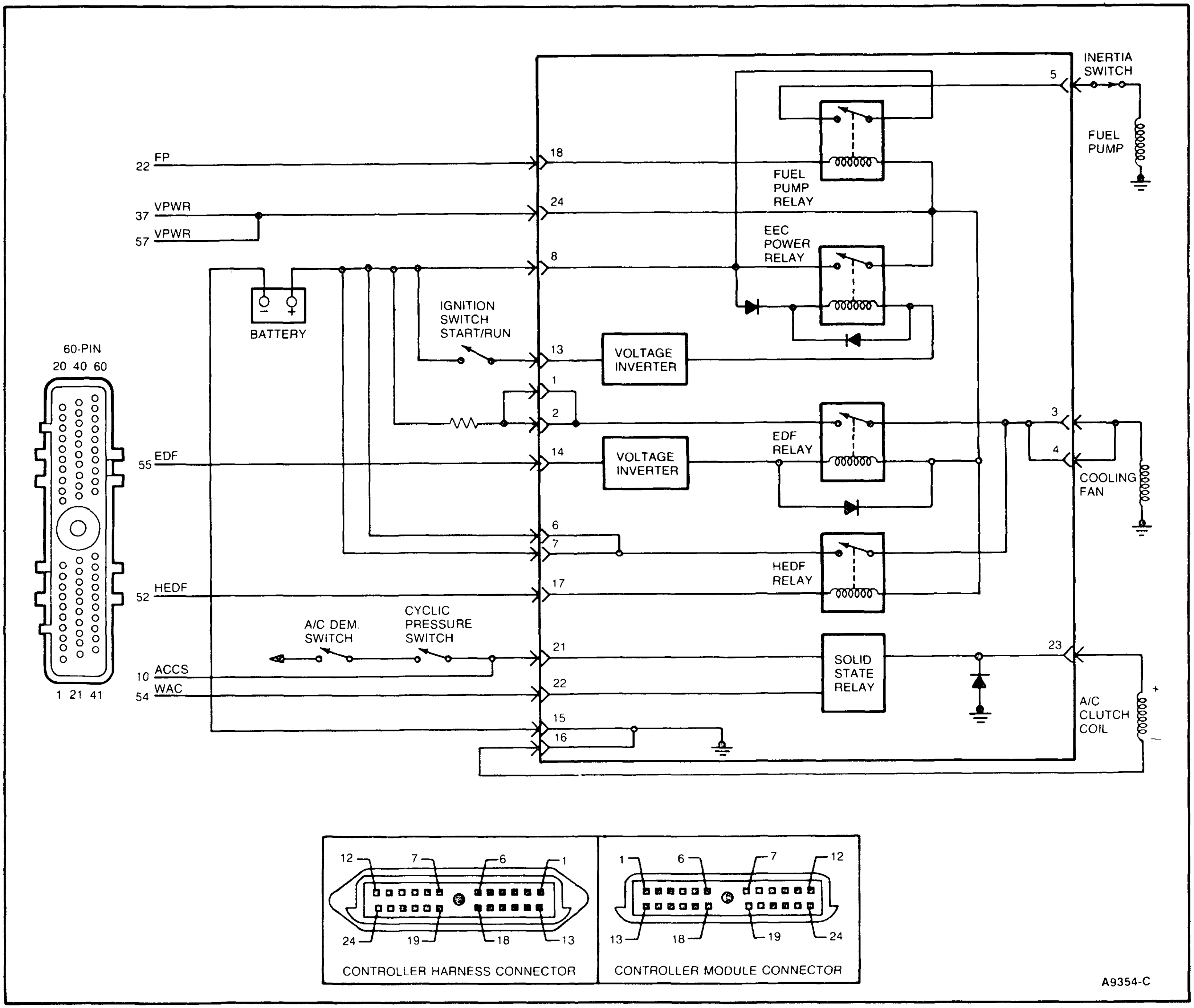
NOTE: WIRING SCHEMATIC SHOWS PIN OUT LOOKING INTO HARNESS CONNECTORS

*REFER TO INTEGRATED CONTROLLER IN THIS SECTION

A9133-C

Integrated Controller Schematic

3.0L EFI



Integrated Controller Usage Pin

3.0L EFI

Pin	Circuit	Color	Applications	Abbreviations
1	181	BR/O	Power to EDF Relay	PT/EDF
2	181	BR/O	Power to EDF Relay	PT/EDF
3	228	BR/Y	Power to Cooling Fan	PTF
4	228	BR/Y	Power to Cooling Fan	PTF
5	787	PK/BK	Power to Fuel Pump	PTP
6	38	BK/O	Power to HEDF Relay	PT/HEDF
7	38	BK/O	Power to HEDF Relay	PT/HEDF
8	37	Y	Battery to EEC Relay	BATT +
13	16	R/LG	Key Power	KEY PWR
14	197	T/O	EDF Circuit	EDF
15	60	BK/LG	Power Ground	PWR GRD
16	57	BK	A/C Clutch Ground	PWR GRD
17	639	PK	HEDF Circuit	HEDF
18	97	T/LG	Fuel Pump	FP
21	883		A/C Cyclic Switch	ACCS
22	331	R	WOT A/C Cut Off	WAC
23	347	BK/Y	Power to A/C	PTAC
24	361	R	Vehicle Power	VPWR

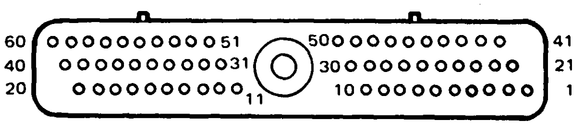
CA9907-A

EEC-IV Module Connector Pin Usage

3.0L EFI

Pin	Circuit	Wire Color	Application	Abbreviations
1	37	Y	Keep Alive Power	KA PWR
2	810	R/LG	Brake On/Off	BOO
3	150	DG/W	Vehicle Speed Sensor +	VSS DIF +
4	11	DG/Y	Ignition Diagnostic Monitor	IDM
6	563	O/Y	Vehicle Speed Sensor —	VSS DIF –
7	354	LG/Y	Engine Coolant Temperature	ECT
10	883	PR/LB	A/C Cycling Switch	ACCS
13	144	O/Y	Vehicle Speed Control Solenoid	SOL +
16	259	BK/O	Ignition Ground	IGN GND
17	201	T/R	Self-Test Output/"CHECK ENGINE" Light	STO/MIL
18	315	DG/P	Transmission 4/3 Switch	THS 4/3
19	237	O/Y	Transmission 3/2 Switch	THS 3/2
20	57	BK	Case Ground	CSE GND
21	68	O/BK	Idle Speed Control (Bypass Air)	ISC-BPA
22	97	T/LG	Fuel Pump	FP
23	310	Y/R	Knock Sensor	KS
24	330	Y/LG	Power Steering Pressure Switch	PSPS
25	357	LG/P	Air Charge Temperature	ACT
26	351	O/W	Reference Voltage	VREF
27	352	BR/LG	Pressure Feedback EGR	PFE
29	94	DG/P	Heated Exhaust Gas Oxygen (Sensor)	HEGO
30	480	P/Y	Neutral Pressure Switch	NPS
31	101	GY/Y	Canister Purge Solenoid	CANP
33	360	DG	EGR Vacuum Regulator (Solenoid)	EVR
34	305	LB/PK	Data Output Link	DOL
35	146	W/PK	Speed Control Vent (Solenoid)	SCVNT
36	324	Y/LG	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
39	461	O	Speed Control Command Switch Ground	SCCS GND
40	60	BK/LG	Power Ground	PWR GND
42	145	GY/BK	Speed Control Vacuum (Solenoid)	SCVAC
45	358	LG/BK	Manifold Absolute Pressure (Sensor)	MAP
46	359	BK/W	Signal Return (Ground)	SIG RTN
47	355	DG/LG	Throttle Position (Sensor)	TP
48	200	W/BK	Self Test Input	STI
49	89	O	Heat Exhaust Gas Oxygen Sensor Ground	HEGO GND
50	151	LB/BK	Speed Control Command Switch	SCCS
52	639	PK	High Electro Drive Fan	HEDF
53	224	T/LB	Lock-Up Solenoid (Transmission)	LUS
54	331	R	Wide Open Throttle (WOT) A/C Cutoff	WAC
55	197	T/O	Electro Drive Fan (Low)	EDF
56	349	DB	Profile Ignition Pick-Up	PIP
57	361	R	Vehicle Power	VPWR
58	95	T/R	Injector Bank 1	INJ 1
59	96	T/O	Injector Bank 2	INJ 2
60	60	BK/LG	Power Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA9379-B

EEC-IV Diagnostic By Symptom

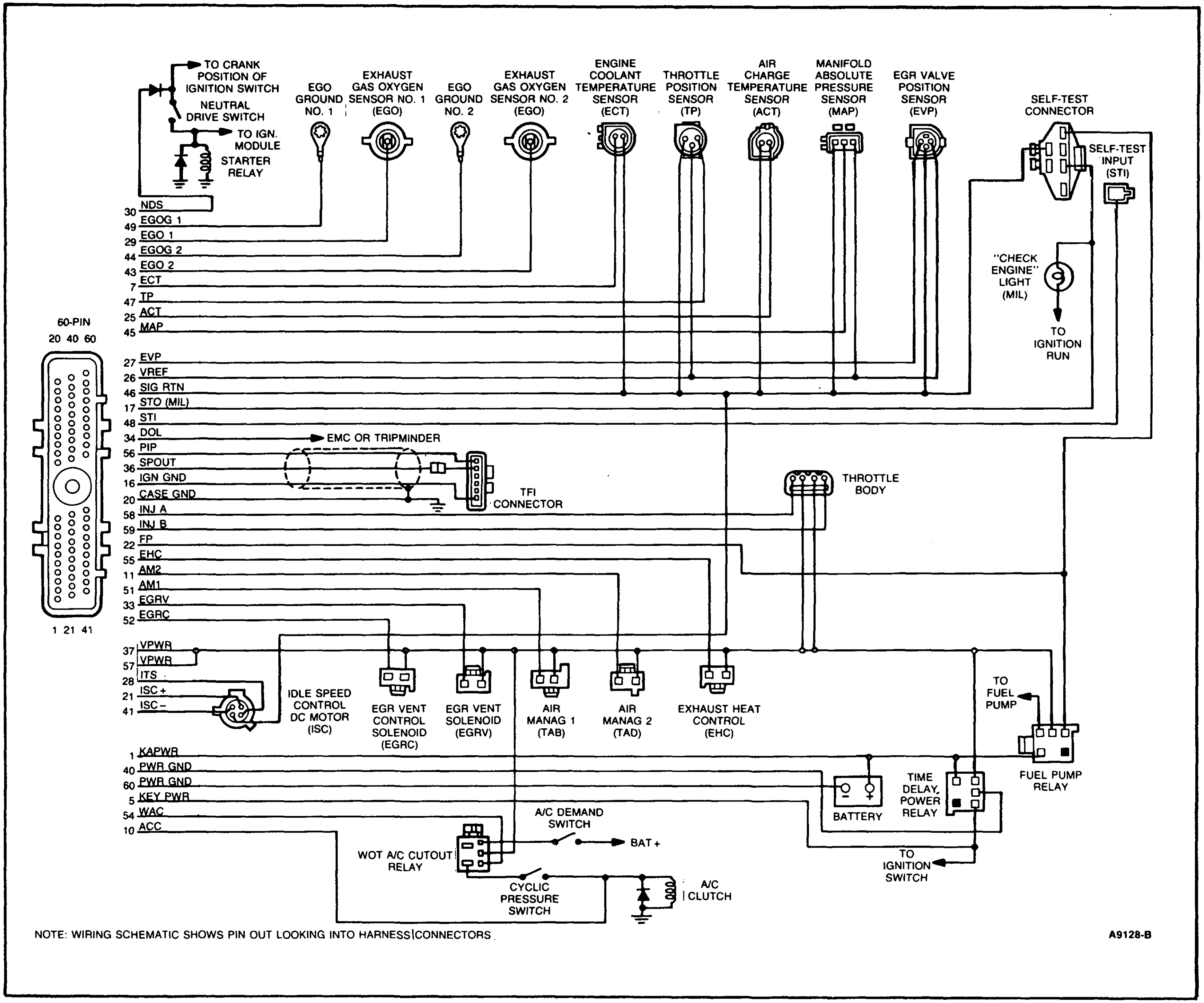
3.8L CFI

SYMPTOM	RESULT	ACTION TO TAKE
• Engine runs rough or miss-fires. • Engine stalls. • Rough idle.		• GO to Pinpoint Test Step S2. • GO to Pinpoint Test Step DF20. • EGR valve function. • Ignition system distibutor cap, rotor, wires, coil, plugs. • Base engine valves, cam timing, compression etc. • Fuel delivery. • Poor power/ground connections.
• Detonation/spark knock (Mustang/Capri only).		• GO to Pinpoint Test Step DG1.
• Low engine rpm with A/C On.		• GO to Pinpoint Test Step FA20. and/or KF1.
• Gasoline fumes under hood.		• GO to Pinpoint Test Step KD1.
• Low idle on cold start-up. • High idle on hot start-up. • Engine diesels.		• GO to Pinpoint Test Step KF16.
• High idle in Drive, automatic transmission only.		• Place transmission in Drive with engine Off. Test neutral drive circuit (test Pin 30) for short to ground. SERVICE as necessary. **NOTE: Circuit should NOT have continuity to ground in Drive.**
• Fuel pump always runs.		• GO to Pinpoint Test Step J15.
• "CHECK ENGINE" light always on.		• GO to Pinpoint Test Step ML1.
• "CHECK ENGINE" light never on.		• GO to Pinpoint Test Step ML5.

CA9963-A

Electrical Schematic

3.8L CFI



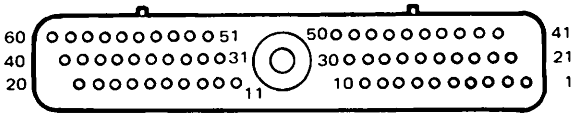
NOTE: WIRING SCHEMATIC SHOWS PIN OUT LOOKING INTO HARNESS CONNECTORS
]

EEC-IV Module Connector Pin Usage

3.8L CFI

Pin	Circuit	Wire Color	Application	Abbreviations
1	38	BK/O	Keep Alive Power	KAPWR
5	16	R/LG	Key Power	KPWR
7	354	LG/Y	Engine Coolant Temperature	ECT
10	347	BK/Y	A/C Clutch	ACC
11	99	LG/BK	Air Management — TAD	AM2
16	259	BK/O	Ignition Ground	IGN GND
17	382	Y/B	Self-Test Output/"CHECK ENGINE" Light	STO/MIL
20	57	BK	Case Ground	CSE GND
21	382	Y/BK	Idle Speed Control (T/X)	ISC+
22	97	T/LG	Fuel Pump	FP
25	357	LG/P	Air Charge Temperature	ACT
26	351	O/W	Reference Voltage	VREF
27	352	BR/LG	EGR Valve Position	EVP
28	265	LG/W	Idle Tracking Switch	ITS
29	94	DG/P	Exhaust Gas Oxygen Sensor — Left	EGO 1(L)
30	32	R/LB	Neutral Drive Switch (T/X)	NDS
33	360	DG	Exhaust Gas Recirculation Vent	EGRV
34	305	LB/P	Data Output Line	DOL
36	324	Y/LG	Spark Output	SPOUT
37	175	BK/Y	Vehicle Power (T/X)	VPWR
40	60	BK/LG	Battery Ground	BATT GND
41	264	W/LB	Idle Speed Control	ISC –
43	90	DB/LG	Exhaust Gas Oxygen Sensor — Right	EGO 2(R)
44	91	GY/R	Exhaust Gas Oxygen Ground — Right	EGOG 2(R)
45	358	LG/BK	Manifold Absolute Pressure (T/X)	MAP
46	359	BK/W	Signal Return	SIG RTN
47	355	DG/LG	Throttle Position Sensor	TP
48	209	W/R	Self-Test Input	STI
49	89	O	Exhaust Gas Oxygen Ground — Left	EGOG 1(L)
51	100	W/R	Air Management — Tab	AM1
52	362	Y	Exhaust Gas Recirculation Control	EGRC
54	73	O/LB	W.O.T. A/C Cut Off	WAC
55	377	W	Exhaust Heat Control	EHC
56	349	DB	Profile Ignition Pick-Up	PIP
57	175	BK/Y	Vehicle Power (T/X)	VPWR
58	95	T/R	Injector 1	INJ 1
59	96	T/O	Injector 2	INJ 2
60	60	BL/LG	Battery Ground	BATT GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA8159-D

EEC-IV Diagnostic By Symptom

5.0L
SEFI

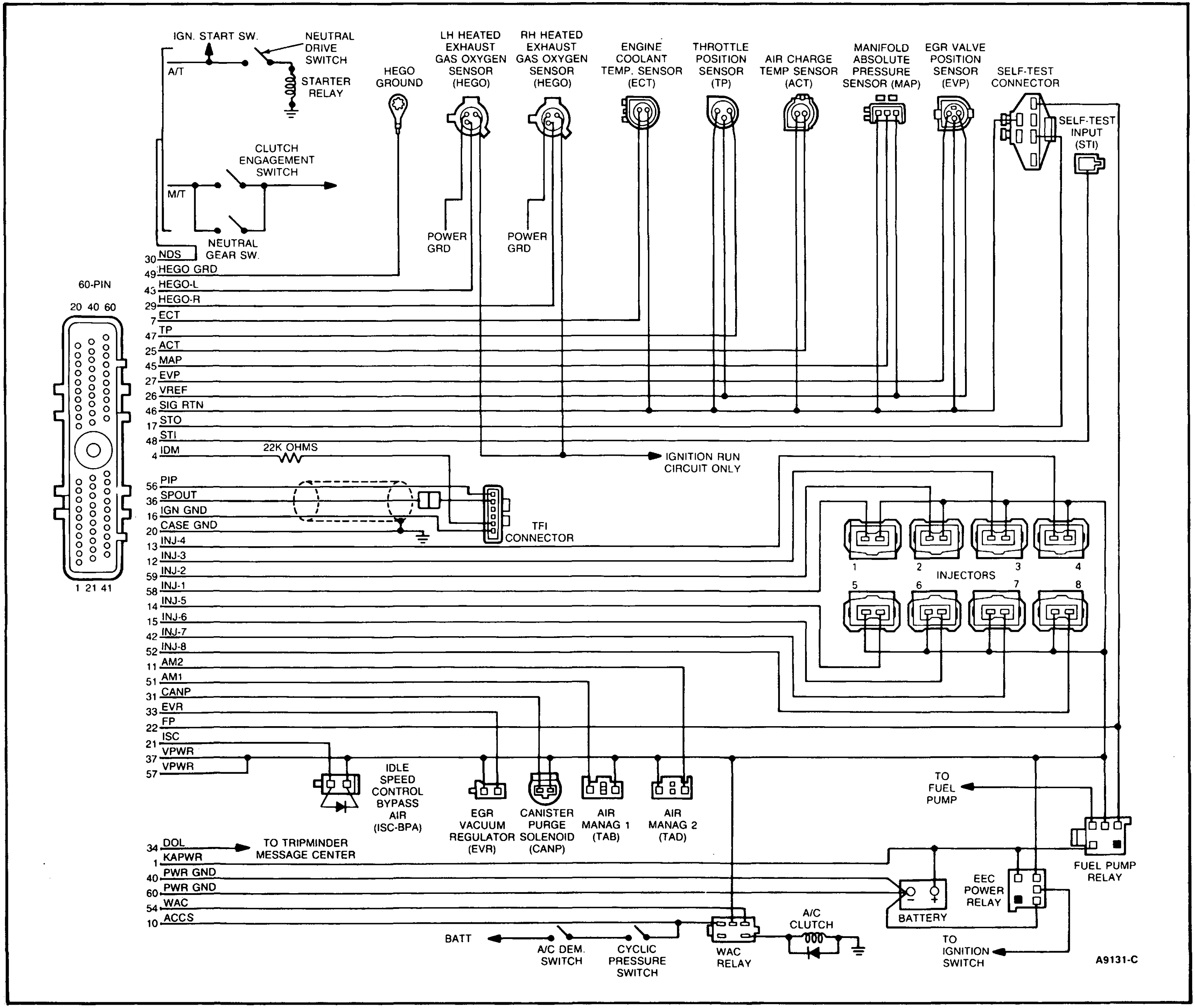
SYMPTOM		RESULT COULD BE	ACTION TO TAKE
7.0	DIAGNOSTICS BY SYMPTOM		
	o Noise emitting from rear of vehicle with key-off.	Fuel pump always on ▷	GO to Pinpoint Test Step J15.
	o Shift indicator light always on or, off.	▷	GO to Pinpoint Test Step KL1.
	o Low idle rpm with A/C ON.	▷	GO to Pinpoint Test Step FA20.
	o A/C does not cutoff during W.O.T.	▷	GO to Pinpoint Test Step KM1.
	o Detonation and, or spark knock.	EGR valve function ▷	GO to EGR Diagnostic Section 6 of Volume "H".
	o Engine stalls during quick test.	Idle speed control ▷	GO to Pinpoint Test Step KE4.
	o Gasoline fumes under hood.	▷	GO to Canister Purge Pinpoint Test Step KD1.
	o Misses. o Engine runs rough. o Engine stalls. o Lack of power. o Erratic RPM. o Surges		o Poor power/ground connections. o Ignitions system distributor cap, rotor, wires, coil, plugs. o Base engine valves, cam timing, compression etc. o GO to Pinpoint Test Step S1 for ISC, MAP, EGR, and Cylinder Balance Test.
	o "CHECK ENGINE" light always on.		o GO to Pinpoint Test Step ML1.
	o "CHECK ENGINE" light never on.		o GO to Pinpoint Test Step ML5.

CA9964-B

Electrical Schematic

5.0L SEFI

ALL EXCEPT 1987½ MARK VII/LINCOLN TOWN CAR CALIBRATION 8-22



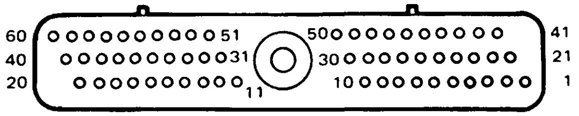
EEC-IV Module Connector Pin Usage

5.0L SEFI

ALL EXCEPT 1987½ MARK VII/LINCOLN TOWN CAR CALIBRATION 8-22

Pin	Car Lines				Application	Abbreviations
	Ford, Mercury, Town Car		Thunderbird, Cougar			
	Crt.#	Wire Color	Crt.#	Wire Color		
1	37	Y	38	BK/O	Keep Alive Power	KAPWR
4	11	DG-Y	189	LB-PK	Ignition Diagnostic Monitor	IDM
7	354	LG/Y	354	LG/Y	Engine Coolant Temperature	ECT
10	883	PK/LB	883	PK/LB	A/C Clutch Signal	ACCS
11	99	LG/BK	99	LG/BK	Air Management	AM2
12	557	BR/Y	557	BR/Y	Injector #3	INJ 3
13	558	BR/LB	558	BR/LB	Injector #4	INJ 4
14	559	T/LB	559	T/LB	Injector #5	INJ 5
15	560	LG	560	LG	Injector #6	INJ 6
16	259	BK/O	259	BK/O	Ignition Ground	IGN GND
17	201	T/R	382	Y/BK	Self-Test Output	STO
20	57	BK	57	BK	Case Ground	CASE GND
21	264	W/LB	264	W/LB	Idle Speed Control	ISC
22	97	T/LG	97	T/LG	Fuel Pump	FP
25	357	LG/P	357	LG/P	Air Charge Temperature Sensor	ACT
26	351	O/W	351	O/W	Reference Voltage	VREF
27	352	BR/LG	352	BR/LG	EGR Valve Position Sensor	EVP
29	94	DG/P	94	DG/P	Heated Exhaust Gas Oxygen Sensor	HEGO-R
30	33	W/PK	376	BR/W	Neutral Drive Switch	NDS
31	101	GY/Y	101	GY/Y	Canister Purge	CANP
33	360	DG	360	DG	EGR Valve Regulator	EVR
34	305	LB/PK	305	LB/PK	Data Output Line	DOL
36	324	Y/LG	324	Y/LG	Spark Output	SPOUT
37	361	R	175	BK/Y	Vehicle Power	VPWR
40	60	BK/LG	60	BK/LG	Power Ground	PWR GND
42	561	T/O	561	T/O	Injector #7	INJ 7
43	90	DB/LG	90	DB/LG	Heated Exhaust Gas Oxygen Sensor	HEGO-L
45	358	LG/BK	356	DB/LG	Manifold Absolute Pressure Sensor	MAP
46	359	BK/W	359	BK/W	Signal Return	SIG RTN
47	355	DG/LG	355	DG/LG	Throttle Position Sensor	TP
48	200	W/BK	209	W/R	Self-Test Input	STI
49	89	O	89	O	Heated EGO Ground	HEGO GND
51	100	W/R	100	W/R	Air Management	AM1
52	562	LB	562	LB	Injector #8	INJ 8
54	73	O/LB	73	O/LB	Wide Open Throttle A/C Cut Off	WAC
56	349	DB	349	DB	Profile Ignition Pick-Up	PIP
57	361	R	175	BK/Y	Vehicle Power	VPWR
58	555	T	555	T	Injector #1	INJ 1
59	556	W	556	W	Injector #2	INJ 2
60	60	BK/LG	60	BK/LG	Power Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA9380-C

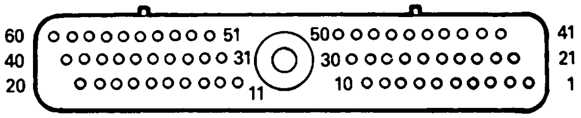
EEC-IV Module Connector Pin Usage

5.0L SEFI

ALL EXCEPT 1987½ MARK VII/LINCOLN TOWN CAR CALIBRATION 8-22

Pin	Car Lines				Application	Abbreviations
	Mark VII, Continental		Mustang, Capri			
	Crt. #	Wire Color	Crt. #	Wire Color		
1	38	BK/O	38	BK/O	Keep Alive Power	KAPWR
4	11	DG/Y	11	DG/Y	Ignition Diagnostic Monitor	IDM
7	354	LG/Y	354	LG/Y	Engine Coolant Temperature	ECT
10	348	LG/P	883	PK/LB	A/C Clutch Signal	ACCS
11	99	LG/BK	99	LG/BK	Air Management	AM2
12	557	BR/Y	557	BR/Y	Injector #3	INJ 3
13	558	BR/LB	558	BR/LB	Injector #4	INJ 4
14	559	T/LB	559	T/LB	Injector #5	INJ 5
15	560	LG	560	LG	Injector #6	INJ 6
16	259	BK/O	259	BK/O	Ignition Ground	IGN GND
17	382	Y/BK	382	Y/BK	Self-Test Output	STO
20	57	BK	57	BK	Case Ground	CASE GND
21	264	W/LB	264	W/LB	Idle Speed Control	ISC
22	97	T/LG	97	T/LG	Fuel Pump	FP
25	357	LG/P	357	LG/P	Air Charge Temperature	ACT
26	351	O/W	351	O/W	Reference Voltage	VREF
27	352	BR/LG	352	BR/LG	EGR Valve Position Sensor	EVP
29	94	DG/P	94	DG/P	Heated Exhaust Gas Oxygen Sensor	HEGO-R
30	—	—	199	LB/Y	Clutch/Neutral Gear Switches (M/T)	NGS and CES
30	33	W/PK	33	W/PK	Neutral Drive Switch (A/T)	NDS
31	101	GY/Y	101	GY/Y	Canister Purge	CANP
33	360	DG	360	DG	EGR Valve Regulator	EVR
34	305	LB/PK	—	—	Data Output Line	DOL
36	324	Y/LG	324	Y/LG	Spark Output	SPOUT
37	361	R	361	R	Vehicle Power	VPWR
40	60	BK/LG	60	BK/LG	Power Ground	PWR GND
42	561	T/O	561	T/O	Injector #7	INJ 7
43	90	DB/LG	90	DB/LG	Heated Exhaust Gas Oxygen Sensor	HEGO-L
45	356	DB/LG	358	LG/BK	Manifold Absolute Pressure	MAP
46	359	BW/W	359	BK/W	Signal Return	SIG RTN
47	355	DG/LG	355	DG/LG	Throttle Position Sensor	TP
48	209	W/R	201	T/R	Self-Test Input	STI
49	89	O	89	O	Heated EGO Ground	HEGO GND
51	100	W/R	100	W/R	Air Management	AMI
52	562	LB	562	LB	Injector #8	INJ 8
54	73	O/LB	73	O/LB	Wide Open Throttle A/C Cut Off	WAC
56	349	DB	349	DB	Profile Ignition Pick-Up	PIP
57	361	R	361	R	Vehicle Power	VPWR
58	555	T	555	T	Injector #1	INJ 1
59	556	W	556	W	Injector #2	INJ 2
60	60	BK/LG	60	BK/LG	Power Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.

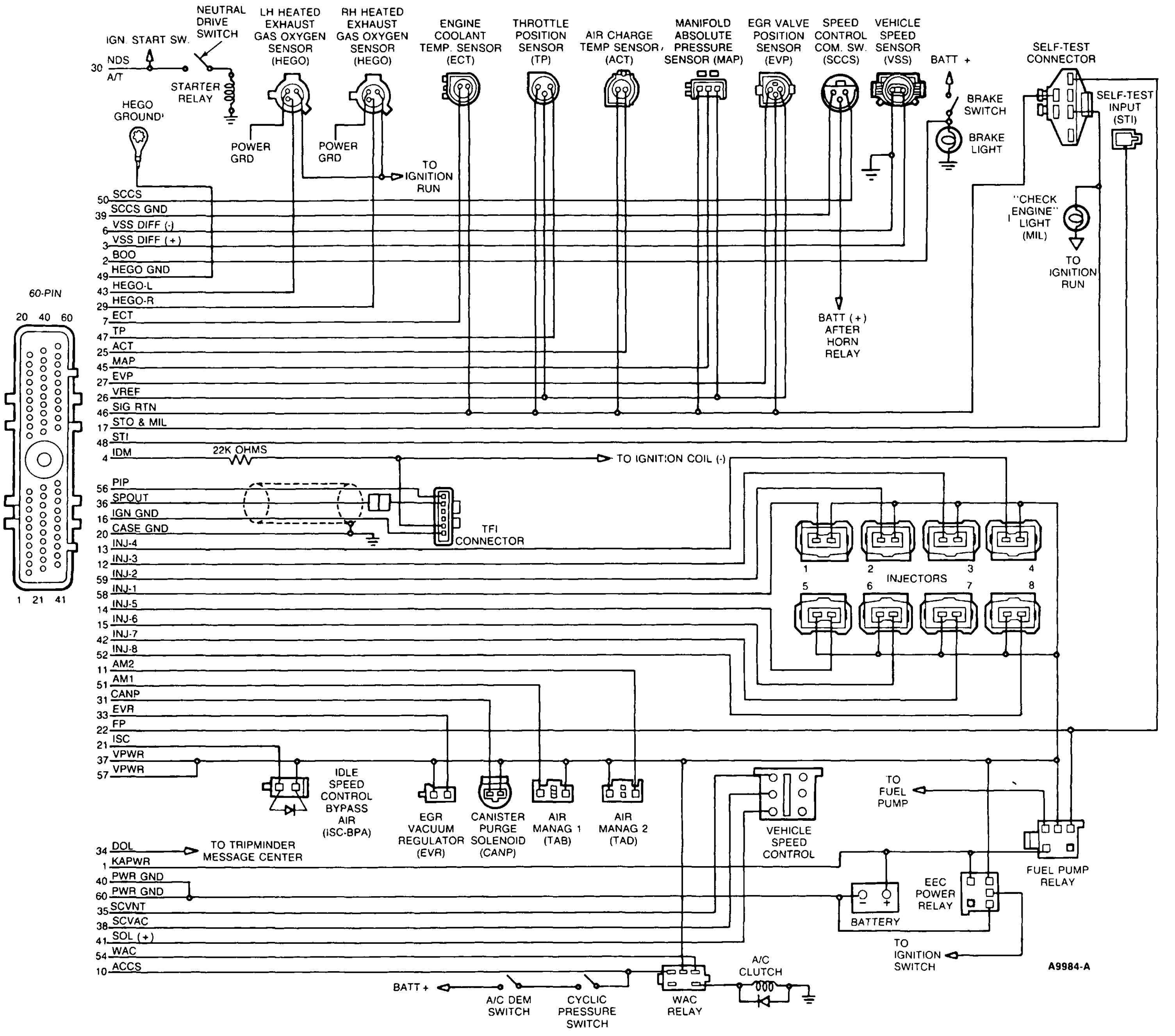


CA9381-C

Electrical Schematic

5.0L SEFI

1987½ MARK VII/LINCOLN TOWN CAR CALIBRATION 8-22



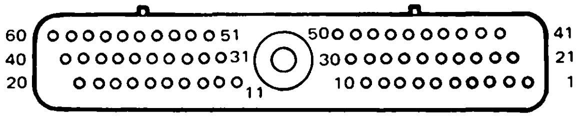
EEC-IV Module Connector Pin Usage

5.0L SEFI

1987½ MARK VII/LINCOLN TOWN CAR CALIBRATION 8-22

Pin	Car Lines				Application	Abbreviations
	Mark VII		Town Car			
	Crt. #	Wire Color	Crt. #	Wire Color		
1	38	BK/O	37	Y	Keep Alive Power	KAPWR
2	511	LG	511	LG	Brake On/Off	BOO
3	150	DG/W	150	DG/W	Vehicle Speed Sensor +	VSS DIF+
4	11	DG/Y	11	DG/Y	Ignition Diagnostic Monitor	IDM
6	683	P/LB	359	BK/W	Vehicle Speed Sensor −	VSS DIF −
7	354	LG/Y	354	LG/Y	Engine Coolant Temperature	ECT
10	348	LG/P	883	PK/LB	A/C Clutch Signal	ACCS
11	99	LG/BK	99	LG/BK	Air Management	AM2
12	557	BR/Y	557	BR/Y	Injector #3	INJ 3
13	558	BR/LB	558	BR/LB	Injector #4	INJ 4
14	559	T/LB	559	T/LB	Injector #5	INJ 5
15	560	LG	560	LG	Injector #6	INJ 6
16	259	BK/O	259	BK/O	Ignition Ground	IGN GND
17	382	Y/BK	201	T/R	Self-Test Output/"Check Engine" Light	STO & MIL
20	57	BK	57	BK	Case Ground	CASE GND
21	264	W/LB	264	W/LB	Idle Speed Control	ISC
22	97	T/LG	97	T/LG	Fuel Pump	FP
25	357	LG/P	357	LG/P	Air Charge Temperature	ACT
26	351	O/W	351	O/W	Reference Voltage	VREF
27	352	BR/LG	352	BR/LG	EGR Valve Position Sensor	EVP
29	94	DG/P	94	DG/P	Heated Exhaust Gas Oxygen Sensor	HEGO-R
30	33	W/PK	33	W/PK	Neutral Drive Switch (A/T)	NDS
31	101	GY/Y	101	GY/Y	Canister Purge	CANP
33	360	DG	360	DG	EGR Valve Regulator	EVR
34	305	LB/PK	305	LB/PK	Data Output Line	DOL
35	146	W/PK	146	W/PK	Speed Control Vent (Solenoid)	SCVNT
36	324	Y/LG	324	Y/LG	Spark Output	SPOUT
37	361	R	361	R	Vehicle Power	VPWR
38	145	GY/BK	145	GY/BK	Speed Control Vacuum (Solenoid)	SCVAC
39	199	LB/Y	679	GY/BK	Speed Control Command Switch Ground	SCCS GND
40	60	BK/LG	60	BK/LG	Power Ground	PWR GND
41	144	O/Y	144	O/Y	Vehicle Speed Control Solenoid	SOL +
42	561	T/O	561	T/O	Injector #7	INJ 7
43	90	DB/LG	90	DB/LG	Heated Exhaust Gas Oxygen Sensor	HEGO-L
45	356	DB/LG	358	LG/BK	Manifold Absolute Pressure	MAP
46	359	BK/W	359	BK/W	Signal Return	SIG RTN
47	355	DG/LG	355	DG/LG	Throttle Position Sensor	TP
48	209	W/R	200	W/BK	Self-Test Input	STI
49	89	O	89	O	Heated EGO Ground	HEGO GND
50	151	LB/PK	151	LB/BK	Speed Control Command Switch	SCCS
51	100	W/R	100	W/R	Air Management	AMI
52	562	LB	562	LB	Injector #8	INJ 8
54	73	O/LB	73	O/LB	Wide Open Throttle A/C Cut Off	WAC
56	349	DB	349	DB	Profile Ignition Pick-Up	PIP
57	361	R	361	R	Vehicle Power	VPWR
58	555	T	555	T	Injector #1	INJ 1
59	556	W	556	W	Injector #2	INJ 2
60	60	BK/LG	60	BK/LG	Power Ground	PWR GND

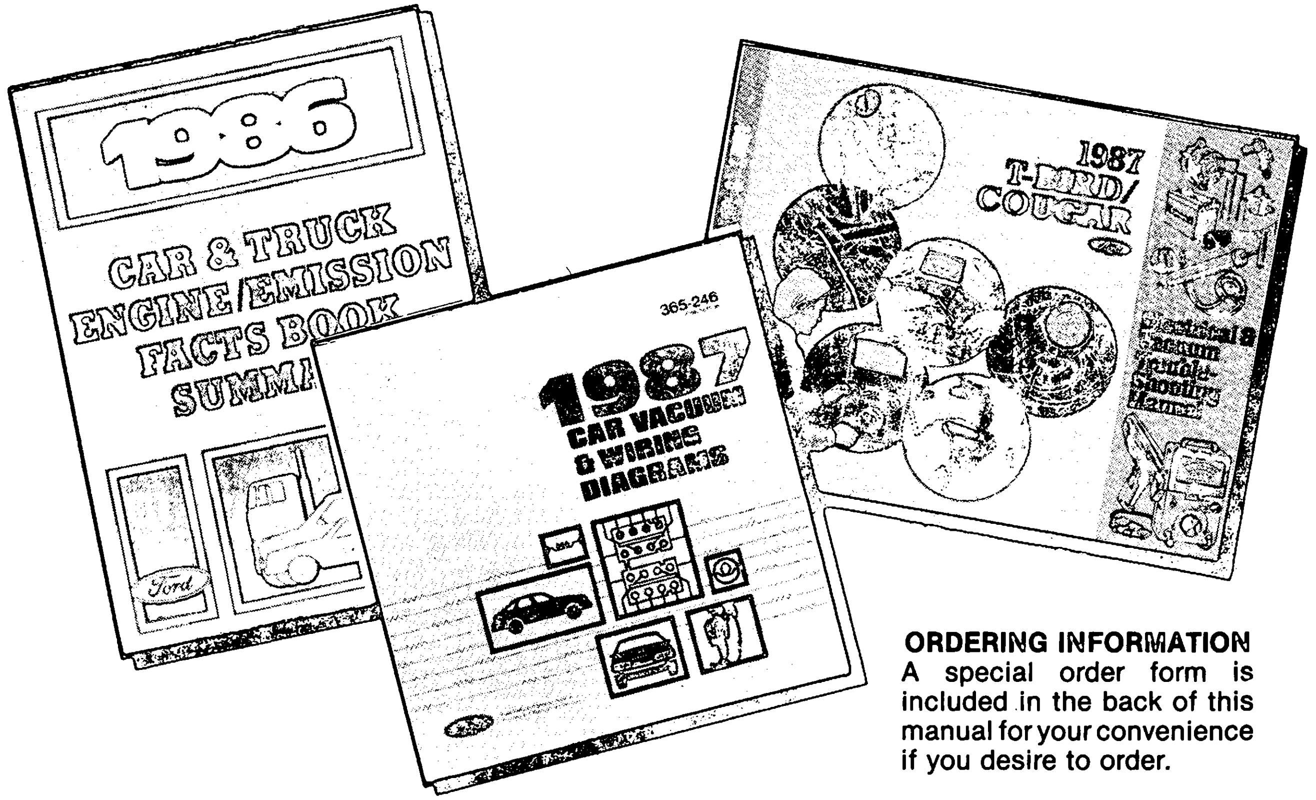
Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA9985-A

OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS


1986
CAR & TRUCK ENGINE/EMISSION FACTS BOOK SUMM
Ford
365-246
1987 CAR VACUUM & WIRING DIAGRAMS
1987 T-BIRD/COUGAR
Electrical & Vacuum Trouble-Shooting Manual

ORDERING INFORMATION
A special order form is included in the back of this manual for your convenience if you desire to order.

ENGINE EMISSIONS FACTS BOOK

- The manual contains complete specifications for each calibration number.
- Published at the conclusion of the model year.

ELECTRICAL & VACUUM TROUBLESHOOTING MANUAL (EVTM)

- Available for all passenger car and light truck vehicles, this publication provides schematics of all electrical and vacuum circuits. Wiring diagrams show how the circuit is powered. Troubleshooting hints are provided to point the technician in a general direction but are not step by step procedures.
- Available in the first quarter of the model year. (One manual for each passenger car and light truck family.)

WIRING & VACUUM DIAGRAMS

- This publication contains wiring diagrams for all Ford and Lincoln/Mercury passenger car and light truck vehicles. A Power Distribution system illustrates the power distribution throughout each vehicle. In addition, all individual electrical circuits are shown for each vehicle line.
- Available in the first quarter of the model year.

Service Specifications Manuals

(CAR AND TRUCK)

- These manuals contain all specifications including maintenance and lubrication contained in the Shop Manuals in a handy pocket size for easy reference.
- Available in the first quarter of the model year.

SECTION 18

EEC IV—Engine Supplement—Light Truck

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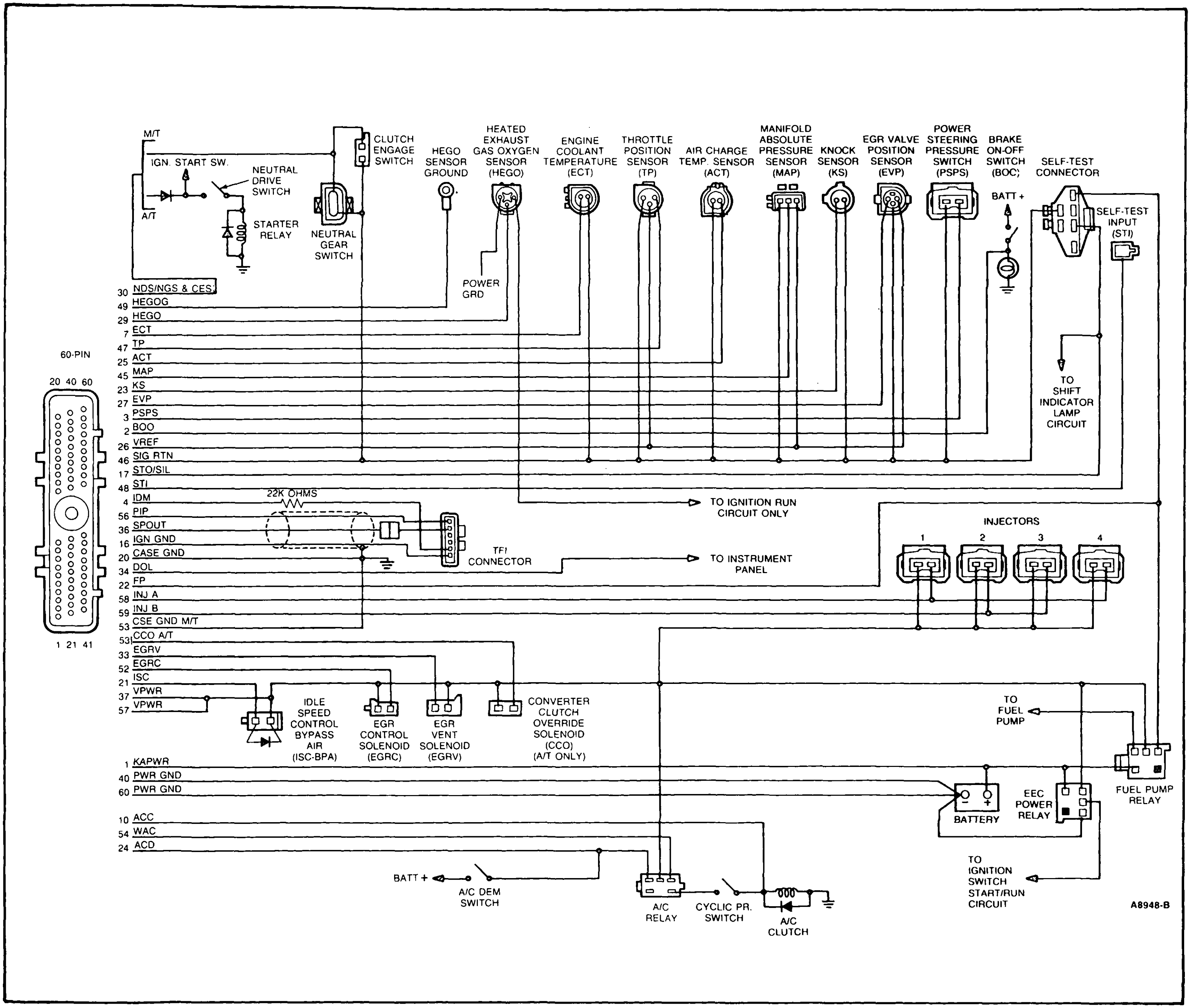
EEC-IV Diagnostic By Symptom

2.3L EFI

SYMPTOM	RESULT	ACTION TO TAKE
• Engine stalls. • Stalls in Self-Test. • Runs rough. • Misses. • Always rich/lean.		• GO to Pinpoint Test Step S1. • Map test, GO to Pinpoint Test Step DF20. • Idle speed control, GO to Pinpoint Test Step KE1. • Poor power/ground connections. • Ignition system distributor cap, rotor, wires, coil, plugs. • Base engine valves, cam timing, compression etc.
• Detonation/spark knock.		GO to Pinpoint Test Step DG1 ,or EGR Diagnostic Section 6 of Volume H.
• A/C compressor runs continuously.		GO to Pinpoint Test Step FA4.
• Low idle during A/C On.		GO to Pinpoint Test Step FA20.
• Shift indicator light always On or Off.		GO to Pinpoint Test Step KL1.
• A/C does not cut-off under WOT conditions. • A/C not functioning.		GO to Pinpoint Test Step KM1.
• Surges with A/C on at idle.		GO to Pinpoint Test Step KM20.
• Stumble after hot re-start (HEGO).		GO to Pinpoint Test Step HE21.
• Stalls during parking maneuvers.		GO to Pinpoint Test Step FF3.
• Fuel pump runs with Key Off.		GO to Pinpoint Test Step J15.

CA8486-A

Electrical Schematic



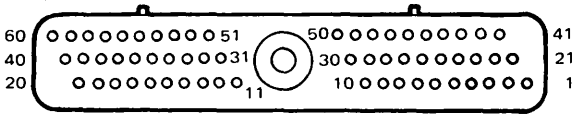
EEC-IV Module Connector Pin Usage

2.3L EFI

RANGER/BRONCO II

Pin	Circuit	Wire Color	Application	Abbreviations
1	37	Y	Keep Alive Power	KAPWR
2	511	LG	Brake On/Off	BOO
3	330	Y-LG	Power Steering Pressure Switch	PSPS
4	11	DG-Y	Ignition Diagnostic Monitor	IDM
7	354	LG-Y	Engine Coolant Temperature	ECT
10	347	BK-Y	A/C Clutch	ACC
16	57	BK	Ignition Ground	IGN GND
17	201	T-R	Self-Test Output/Shift Indicator Light	STO/SIL
20	57	BK	Case Ground	CSE GND
21	67	GY-W	Idle Speed Control	ISC
22	97	T-LG	Fuel Pump	FP
23	99	LG-BK	Knock Sensor	KS
24	348	LG-P	A/C Demand	ACD
25	310	Y-R	Air Charge Temperature	ACT
26	351	O-W	Reference Voltage	VREF
27	352	BR-LG	EGR Valve Position	EVP
29	94	DG-P	Heated Exhaust Gas Oxygen Sensor	HEGO
30	150	DG-W	Neutral Drive Switch (A/T)	NDS
30	200	W-BK	Neutral Gear Switch and Clutch Engage Switch (M/T)	NGS/CES
33	360	DG	Exhaust Gas Recirculation Vent	EGRV
36	324	Y-LG	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
40	60	BK-LG	Power Ground	PWR GND
45	356	DB-LG	Manifold Absolute Pressure	MAP
46	359	BK-W	Signal Return	SIG RTN
47	355	DG-LG	Throttle Position Sensor	TP
48	100	W-R	Self-Test Input	STI
49	89	O	Heated Exhaust Gas Oxygen Sensor Ground	HEGOG
52	362	Y	Exhaust Gas Recirculation Control	EGRC
53	237	O-Y	Clutch Converter Override (A/T only)	CCO
54	331	R	W.O.T. A/C Cut Off	WAC
56	349	DB	Profile Ignition Pick-Up	PIP
57	361	R	Vehicle Power	VPWR
58	96	T-O	Injector 1 (Bank 1)	INJ 1
59	95	T-R	Injector 2 (Bank 2)	INJ 2
60	60	BK-LG	Power Ground	PWR GRD

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA8348-D

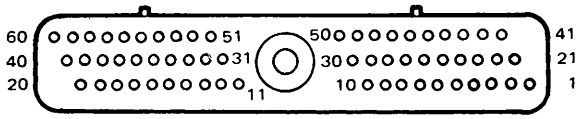
EEC-IV Module Connector Pin Usage

2.3L
EFI

AEROSTAR

Pin	Circuit	Wire Color	Application	Abbreviations
1	37	Y	Keep Alive Power	KAPWR
2	810	R-LG	Brake On-Off	BOO
3	330	Y-LG	Power Steering Pressure Switch	PSPS
4	11	DG-Y	Ignition Diagnostic Monitor	IDM
7	354	LG-Y	Engine Coolant Temperature	ECT
10	347	BK-Y	A/C Clutch	ACC
16	259	BK-O	Ignition Ground	IGN GND
17	201	T-R	Self-Test Output/Shift Indicator Light	STO/SIL
20	57	BK	Case Ground	CSE GND
21	67	GY-W	Idle Speed Control	ISC
22	97	T-LG	Fuel Pump	FP
23	99	LG-BK	Knock Sensor	KS
24	348	LG-P	A/C Demand	ACD
25	357	LG-P	Air Charge Temperature	ACT
26	351	O-W	Reference Voltage	VREF
27	352	BR-LG	EGR Valve Position	EVP
29	94	DG-P	Heated Exhaust Gas Oxygen Sensor	HEGO
30	150	DG-W	Neutral Drive Switch (A/T)	NDS
30	200	W-BK	Neutral Gear Switch and Clutch Engage Switch (M/T)	NGS/CES
33	360	DG	Exhaust Gas Recirculation Vent	EGRV
34	305	LB-PK	Data Output Link	DOL
36	324	Y-LG	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
40	60	BK-LG	Power Ground	PWR GND
45	356	DB-LG	Manifold Absolute Pressure	MAP
46	359	BK-W	Signal Return	SIG RTN
47	355	DG-LG	Throttle Position Sensor	TP
48	100	W-R	Self-Test Input	STI
49	89	O	Heated Exhaust Gas Oxygen Ground	HEGOG
52	362	Y	Exhaust Gas Recirculation Control	EGRC
53	237	O-Y	Clutch Converter Override (A/T only)	CCO
53	48	Uninsulated	Case Ground (M/T)	CSE GND
54	331	R	W.O.T. A/C Cut Off	WAC
56	349	DB	Profile Ignition Pick-Up	PIP
57	361	R	Vehicle Power	VPWR
58	96	T-O	Injector 1 (Bank 1)	INJ 1
59	95	T-R	Injector 2 (Bank 2)	INJ 2
60	60	BK-LG	Power Ground	PWR GRD

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



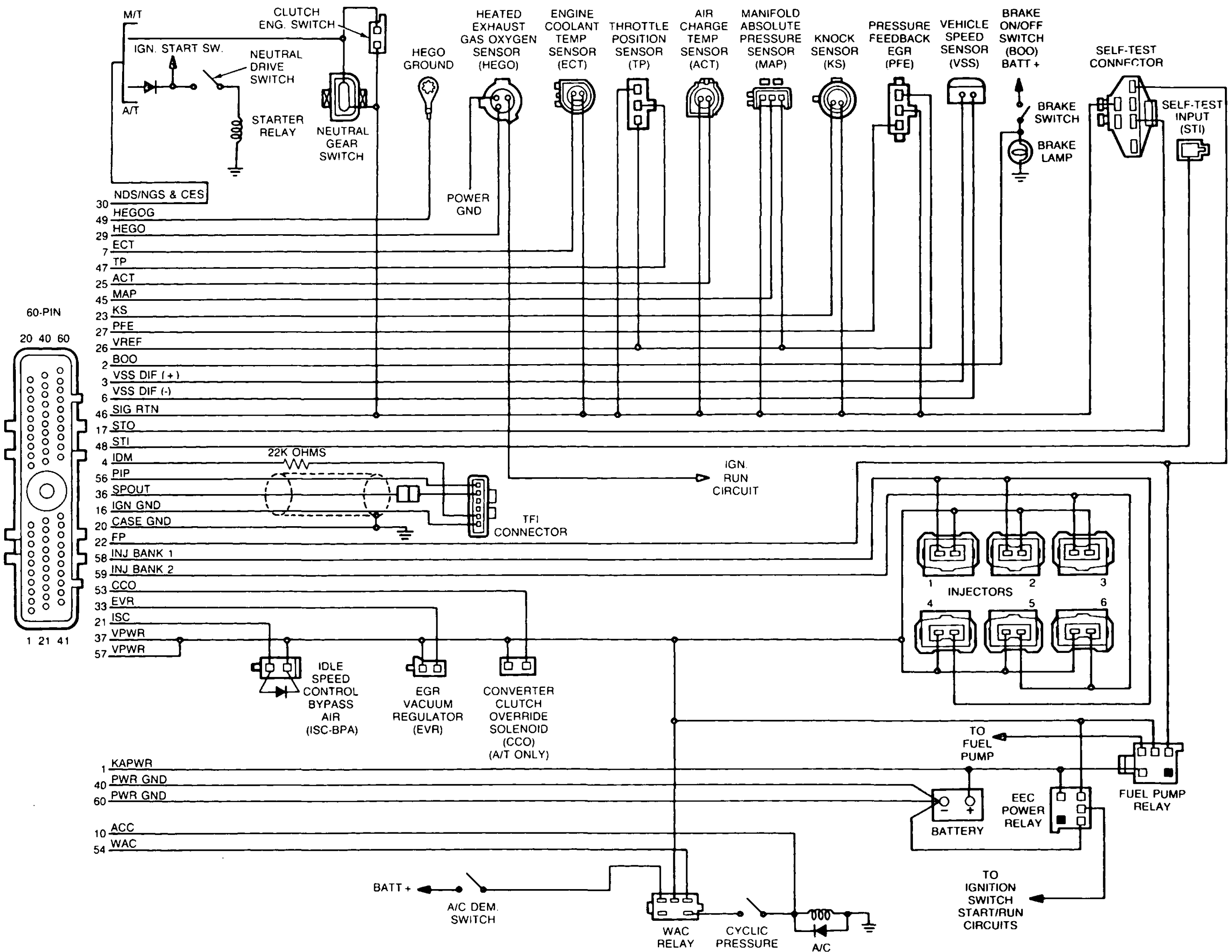
CA8349-D

EEC-IV Diagnostic By Symptom

2.9L EFI

SYMPTOM	RESULT	ACTION TO TAKE
• Engine stalls. • Stalls in Self-Test. • Runs rough. • Misses.	Always rich/lean. ▶	• GO to Pinpoint Test Step **S1**. • Map test GO to Pinpoint Test Step **DF-20**. • Poor power/ground connections. • Ignition system distributor cap, rotor, wires, coil, plugs. • Base engine valves cam timing, compression etc.
• Detonation/spark knock.		GO to Pinpoint Test Step **DG1**.
• Low idle rpm with A/C On.		GO to Pinpoint Test Step **FA20**.
• A/C does not cut-off under WOT conditions. • A/C not functioning.		GO to Pinpoint Test Step **KM1**.
• Stumble after hot re-start (HEGO).		GO to Pinpoint Test Step **HG21**.
• Stalls during parking maneuvers.		GO to Pinpoint Test Step **FF3**.
• Fuel pump runs with Key Off.		GO to Pinpoint Test Step **J15**.

CA8487-A



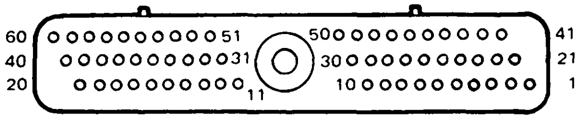
NOTE: WIRING SCHEMATIC SHOWS PIN OUT LOOKING INTO HARNESS CONNECTORS

EEC-IV Module Connector PIN Usage

2.9L EFI

Pin	Circuit	Wire Color	Application	Abbreviations
1	37	Y	Keep Alive Power	KAPWR.
2	511	LG	Brake On-Off	BOO
3	150	DG/W	Vehicle Speed Sensor +	VSS DIF +
4	11	DG/Y	Ignition Diagnostic Monitor	IDM
6	397	BK/W	Vehicle Speed Sensor −	VSS DIF −
7	354	LG/Y	Engine Coolant Temp. Sensor	ECT
10	347	BK/Y	A/C Clutch	ACC
16	57	BK	Ignition Ground	IGN GND
17	201	T/R	Self-Test Output	STO
20	60	B/LG	Case Ground	CASE GND
21	67	GY/W	Idle Speed Control	ISC
22	97	T/LG	Fuel Pump	FP
23	310	Y/R	Knock Sensor	KS
25	357	LG/P	Air Charge Temp. Sensor	ACT
26	351	O/W	Reference Voltage	VREF
27	352	BR/LG	Pressure Feedback Electronic Sensor (EGR)	PFE
29	94	DG/P	Heated Exhaust Gas Oxygen Sensor	HEGO
30	33	W/PK	Neutral Drive Switch (A/T Only)	NDS
30	200	W/BK	Neutral Gear Switch and Clutch Engage Switch (M/T)	NGS/CES
33	362	Y	EGR Vacuum Regulator	EVR
36	324	Y/LG	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
40	60	BK/LG	Power Ground	PWR GND
45	356	DB/LG	Manifold Absolute Pressure Sensor	MAP
46	359	BK/W	Signal Return	SIG RTN
47	355	DG/LG	Throttle Position Sensor	TP
48	100	W/R	Self-Test Input	STI
49	89	O	Heated Exhaust Gas Oxygen Sensor Ground	HEGOG
53	237	O/Y	Clutch Converter Override (Not used on M/T)	CCO
54	331	R	W.O.T. A/C Cut-Off	WAC
56	349	DB	Profile Ignition Pick-up	PIP
57	361	R	Vehicle Power	VPWR
58	265	LG/W	Injector Bank 1 (Controls Engine Cylinder Numbers 1, 2 and 4)	INJ 1
59	95	T/R	Injector Bank 2 (Controls Engine Cylinder Numbers 3, 5 and 6)	INJ 2
60	60	BK/LG	Power Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA9375-B

EEC-IV Diagnostic By Symptom

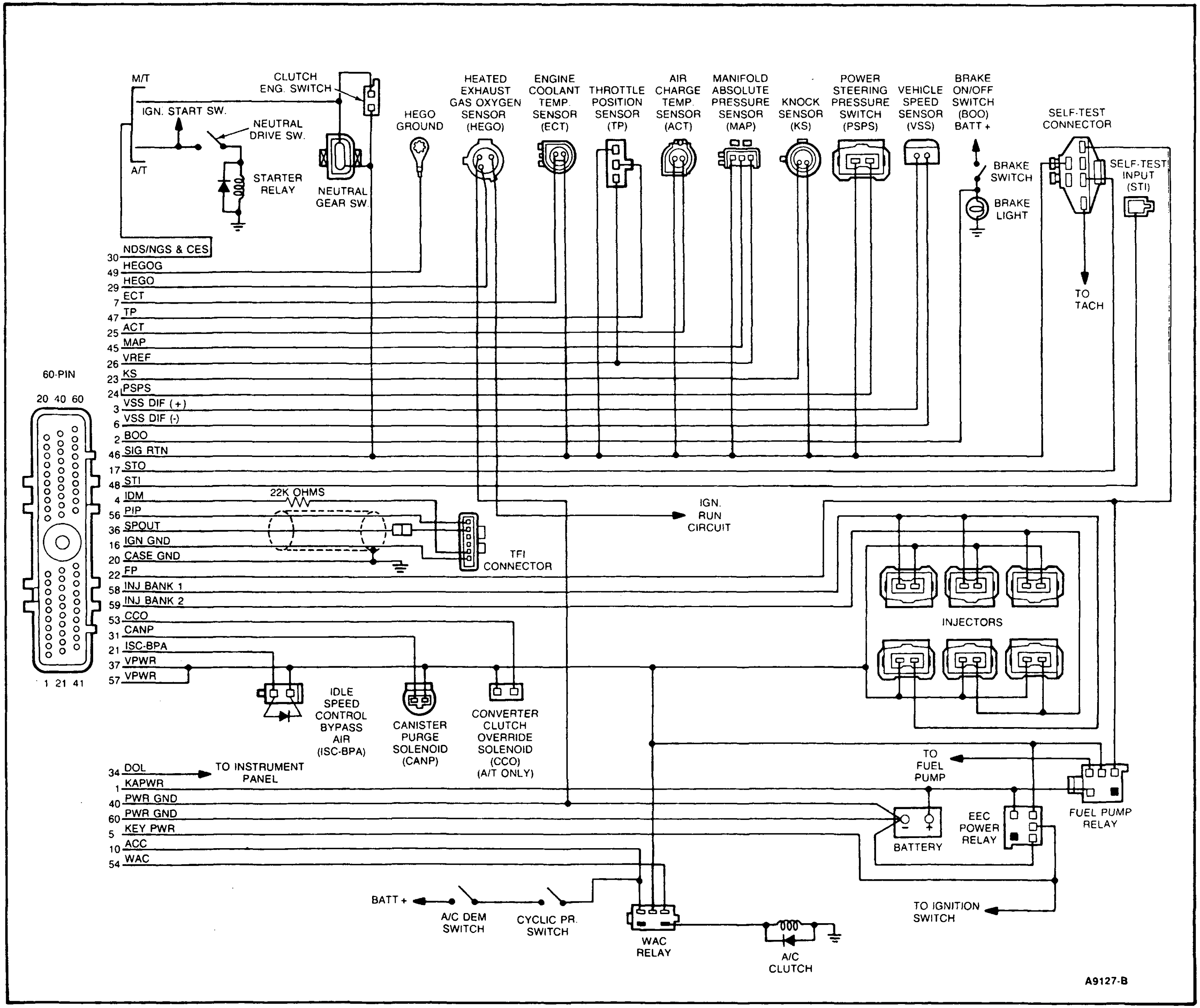
3.0L EFI

SYMPTOM	RESULT	ACTION TO TAKE
• Engine stalls. • Stalls in Self-Test. • Runs rough. • Misses.	Always rich/lean. ▶	○ GO to Pinpoint Test Step **S1**. ○ Map test GO to Pinpoint Test Step **DF-20**. ○ Poor power/ground connections. ○ Ignition system distributor cap, rotor, wires, coil, plugs. ○ Base engine valves cam timing, compression etc.
• Detonation/spark knock.		GO to Pinpoint Test Step **DG1**.
• Lack of fast idle assist with A/C On.		GO to Pinpoint Test Step **FA1**.
• Shift indicator light always On or Off.		GO to Pinpoint Test Step **KL1**.
• A/C does not cut-off under WOT conditions.		GO to Pinpoint Test Step **KM1**.
• Stumble after hot re-start (HEGO).		GO to Pinpoint Test Step **HG21**.
• Stalls during parking maneuvers.		GO to Pinpoint Test Step **FF3**.
• Poor idle quality. • Rolling idle. • Shifts harshly. • Poor fuel economy.		GO to Pinpoint Test Step **T90**.
• Noise emitting from rear of vehicle with Key Off.	Fuel pump always on.	GO to Pinpoint Test Step **J15**.

CA8488-A

Electrical Schematic

3.0L EFI

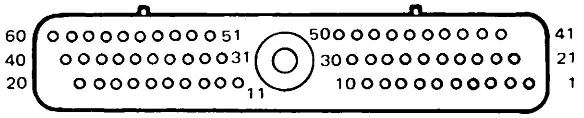


EEC-IV Module Connector Pin Usage

3.0L EFI

Pin	Circuit	Wire Color	Application	Abbreviations
1	37	Y	Keep Alive Power	KAPWR
2	810	R/LG	Brake ON-OFF	BOO
3	150	DG/W	Vehicle Speed Sensor Differential Positive	VSSDIF +
4	11	DG/Y	Ignition Diagnostic Monitor	IDM
6	397	BK/W	Vehicle Speed Sensor Differential Negative	VSSDIF −
7	354	LG/Y	Engine Coolant Temperature Sensor	ECT
10	347	BK/Y	A/C Cycling Pressure Switch	ACCS
16	259	BK/O	Ignition Ground	IGN GND
17	201	T/R	Self-Test Output	STO
20	57	BK	Case Ground	CASE GND
21	68	O/BK	Idle Speed Control (Bypass Air)	ISC-BPA
22	97	T/LG	Fuel Pump	FP
23	310	Y/R	Knock Sensor	KS
24	330	Y/LG	Power Steering Pressure Switch	PSPS
25	357	LG/P	Air Charge Temperature Sensor	ACT
26	351	O/W	Reference Voltage	VREF
29	94	DG/P	Heated Exhaust Gas Oxygen Sensor	HEGO
30	200	W/BK	Neutral Gear Switch and Clutch Engage Switch M/T	NGS and CES
30	151	LB/BK	Neutral Drive Switch A/T Only	NDS
31	101	GY/Y	Canister Purge	CANP
34	305	LB/P	Data Output Link	DOL
36	324	Y-LG	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
40	60	BK/LG	Power Ground	PWR GND
45	356	DB/LG	Manifold Absolute Pressure Sensor	MAP
46	359	BK/W	Signal Return	SIG RTN
47	355	DG/LG	Throttle Position Sensor	TP
48	100	W/R	Self-Test Input	STI
49	89	O	Heated Exhaust Gas Oxygen Sensor Ground	HEGO GND
53	237	O/Y	Converter Clutch Override (Not used on M/T)	CCO
54	331	R	W.O.T. A/C Cut-Off	WAC
56	349	DB	Profile Ignition Pick-up	PIP
57	361	R	Vehicle Power	VPWR
58	96	T/O	Injector Bank 1	INJ 1
59	95	T/R	Injector Bank 2	INJ 2
60	60	BL/LG	Power Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA9376-B

EEC-IV Diagnostic By Symptom

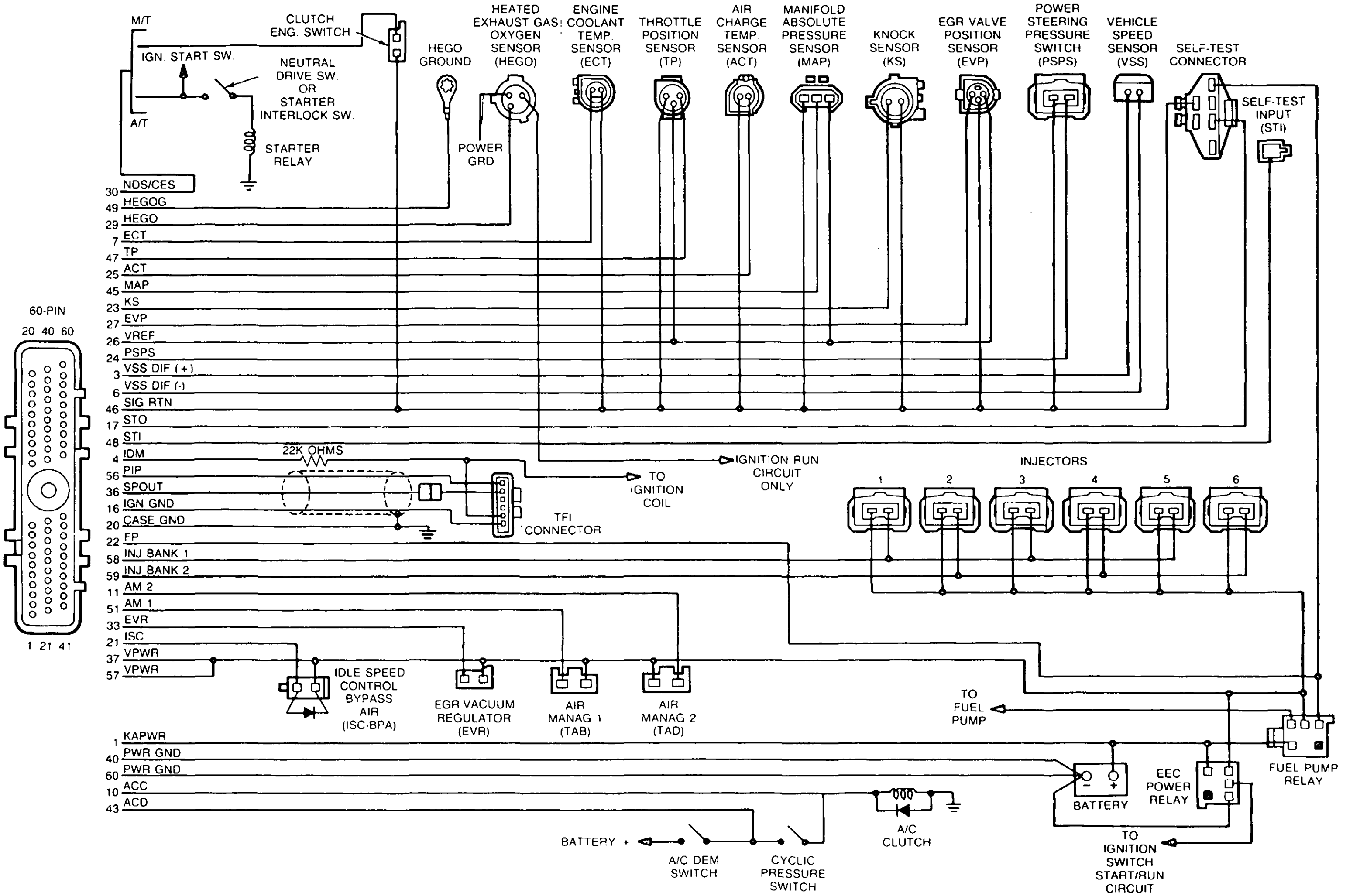
4.9L EFI

SYMPTOM	RESULT	ACTION TO TAKE
• Engine stalls. • Stalls in Self Test. • Runs rough. • Misses.	Always rich/lean	• GO to Pinpoint Test Step S1. • Map test. GO to Pinpoint Test Step DF20. • Idle Speed Control. GO to Pinpoint Test Step KE1. • Poor power/ground connections. • Ignition system distributor cap, rotor, wires, coil, plugs. • Base engine valves, cam timing, compression etc.
• Detonation/spark knock.		• GO to Pinpoint Test Step DG1.
• Low idle rpm with A/C On.		• GO to Pinpoint Test Step FA20.
• Shift indicator light always On or always Off.		• GO to Pinpoint Test Step KL1.
• Stumble after hot re-start (HEGO).		• GO to Pinpoint Test • Step HG21.
• Stalls during parking maneuvers.		• GO to Pinpoint Test Step FF3.
• Fuel pump runs with Key Off.		• GO to Pinpoint Test Step J15.

CA8489-A

Electrical Schematic

4.9L EFI



NOTE: WIRING SCHEMATIC SHOWS PIN OUT LOOKING INTO HARNESS CONNECTOR.

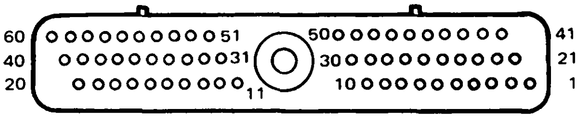
EEC-IV Module Connector Pin Usage

4.9L EFI

ECONOLINE

Pin	Circuit	Wire Color	Application	Abbreviations
1	37	BK/Y	Keep Alive Power	KAPWR
3	145	BK	Vehicle Speed Sensor +	VSS DIF +
4	11	BK/Y	Ignition Diagnostic Module	IDM
6	146	BK	Vehicle Speed Sensor −	VSS DIF −
7	354	GR/Y	Engine Coolant Temperature Sensor	ECT
10	347	BK	A/C Clutch	ACC
11	200	BL	Air Management 2 (TAD)	AM2
16	259	BK/R	Ignition Ground	IGN GND
17	201	BL/Y	Self-Test Output	STO
20	57	BK	Case Ground	CASE GND
21	264	BL	Idle Speed Control — Bypass Air	ISC — BPA
22	97	O	Fuel Pump	FP
23	99	BK	Knock Sensor	KS
24	330	Y/G	Power Steering Pressure Switch	PSPS
25	310	R/BK	Air Charge Temperature Sensor	ACT
26	351	R	Reference Voltage	VREF
27	352	BR/GR	EGR Valve Position Sensor	EVP
29	94	GR/P	Heated Exhaust Gas Oxygen Sensor	HEGO
30	33	Y	Neutral Drive Switch (A/T)	NDS
30	199	BK/O	Clutch Engage Switch (M/T)	CES
33	360	W/BL	EGR Vacuum Regulator (Solenoid)	EVR
36	324	Y/GR	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
40	60	BK/W	Power Ground	PWR GND
43	348	GR/W	A/C Demand	ACD
45	356	BL/GR	Manifold Absolute Pressure	MAP
46	359	BK/W	Signal Return	SIG RTN
47	355	GR	Throttle Position Sensor	TP
48	100	BK/R	Self-Test Input	STI
49	89	O	Heated Exhaust Gas Oxygen Ground	HEGOG
51	190	Y	Air Management 1 (TAB)	AM1
56	349	BR	Profile Ignition Pick-Up	PIP
57	361	R	Vehicle Power	VPWR
58	96	O/BK	Injector Bank 1 (Controls Engine Cylinder Numbers 1, 3 and 5)	INJ BANK 1
59	95	W	Injector Bank 2 (Controls Engine Cylinder Numbers 2, 4 and 6)	INJ BANK 2
60	60	BK/W	Power Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA7795-D

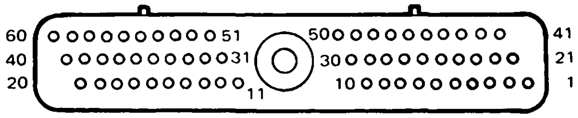
EEC-IV Module Connector Pin Usage

4.9L EFI

F-SERIES/BRONCO

Pin	Circuit	Wire Color	Application	Abbreviations
1	37	Y	Keep Alive Power	KAPWR
3	150	DG/W	Vehicle Speed Sensor +	VSS DIF +
4	11	DG/Y	Ignition Diagnostic Module	IDM
6	57	BK	Vehicle Speed Sensor -	VSS DIF -
7	354	LG/Y	Engine Coolant Temperature Sensor	ECT
10	347	BK/Y	A/C Clutch	ACC
11	200	W/BK	Air Management 2 (TAD)	AM 2
16	259	BK/O	Ignition Ground	IGN GND
17	201	T/R	Self-Test Output	STO
20	57	BK	Case Ground	CASE GND
21	67	GY/W	Idle Speed Control — Bypass Air	ISC-BPA
22	97	T/LG	Fuel Pump	FS
23	99	LG/BK	Knock Sensor	KS
24	330	Y/LG	Power Steering Pressure Switch	PSPS
25	310	Y/R	Air Charge Temperature Sensor	ACT
26	350	O/W	Reference Voltage	VREF
27	352	BR/LG	EGR Valve Position Sensor	EVP
29	94	DG/P	Heated Exhaust Gas Oxygen Sensor	HEGO
30	481	GY/Y	Neutral Drive Switch	NDS
33	360	DG	EGR Vacuum Regulator (Solenoid)	EVR
36	324	Y/LG	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
40	60	BK/LG	Power Ground	PWR GND
43	348	LG/P	A/C Demand	ACD
45	356	DB/LG	Manifold Absolute Pressure	MAP
46	359	BK/W	Signal Return	SIG RTN
47	355	DG/LB	Throttle Position Sensor	TP
48	100	W/R	Self-Test Input	STI
49	89	O	Heated Exhaust Gas Oxygen Ground	HEGOG
51	190	W/R	Air Management 1	AM 1
56	349	DB	Profile Ignition Pick-Up	PIP
57	361	R	Vehicle Power	VPWR
58	96	T/O	Injector Bank 1 (Controls Engine Cylinder Numbers 1, 3 and 5)	INJ BANK 1
59	95	T/R	Injector Bank 2 (Controls Engine Cylinder Numbers 2, 4 and 6)	INJ BANK 2
60	60	BK/LG	Power Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA8347-C

EEC-IV Diagnostic By Symptom

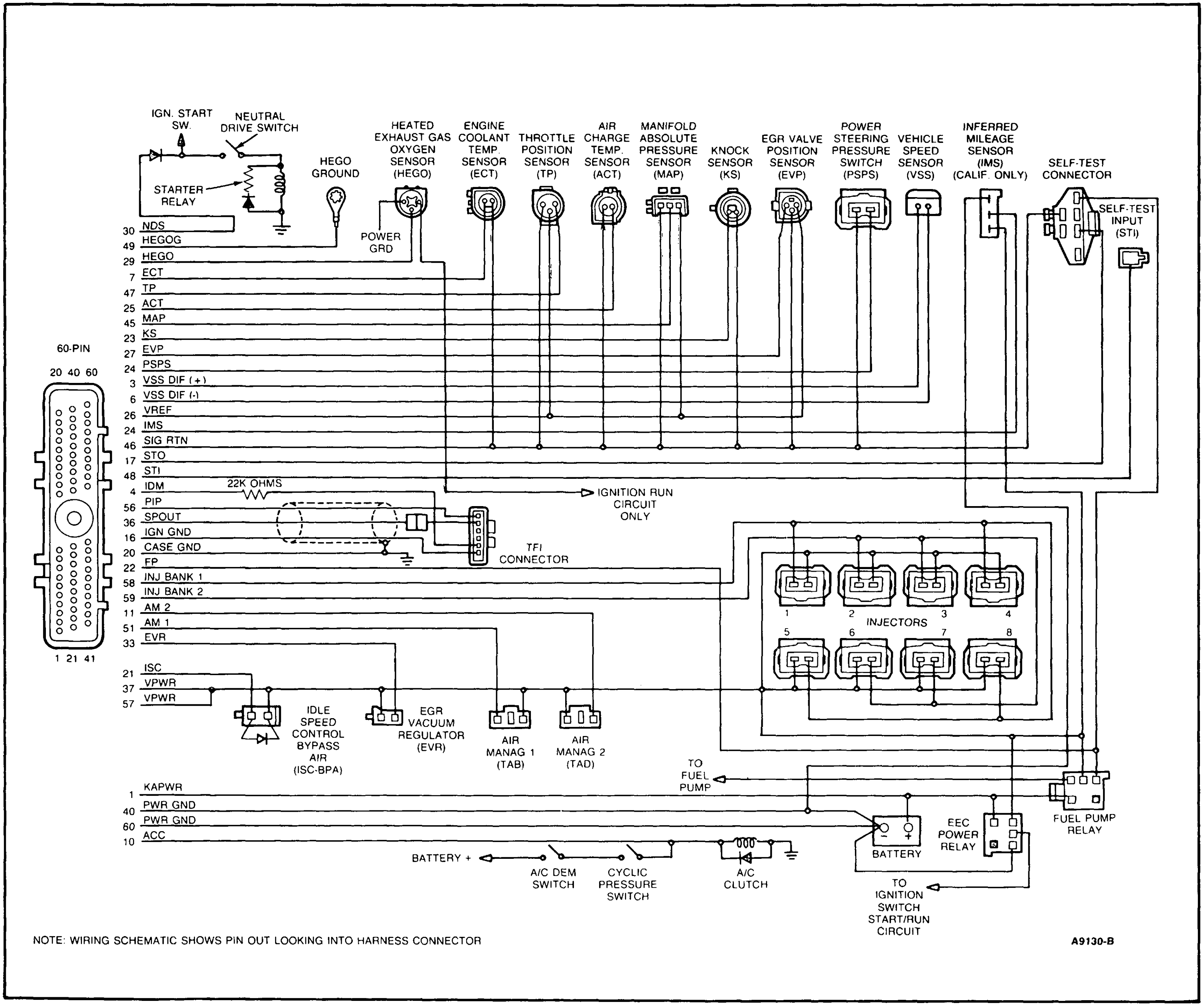
5.0L EFI

SYMPTOM	RESULT	ACTION TO TAKE
• Engine stalls. • Stalls in Self-Test. • Runs rough. • Misses.	Always rich/lean. ▶	• GO to Pinpoint Test Step S1. • Map test, GO to Pinpoint Test Step DF20. • Idle Speed Control, GO to Pinpoint Test Step KE1. • Poor power/ground connections. • Ignition system distributor cap, rotor, wires, coil, plugs. • Base engine valves, cam timing, compression etc.
• Detonation/spark knock.		GO to Pinpoint Test Step DG1.
• Low idle rpm with A/C On.		GO to Pinpoint Test Step FA20.
• Shift indicator light always On or Off.		GO to Pinpoint Test Step KL1.
• A/C does not cut-off under WOT conditions.		GO to Pinpoint Test Step KM1.
• Surges with A/C on at idle.		GO to Pinpoint Test Step KM20.
• Stumble after hot re-start (HEGO).		GO to Pinpoint Test Step HH21.
• Stalls during parking maneuvers.		GO to Pinpoint Test Step FF3.
• Fuel pump runs with Key Off.		GO to Pinpoint Test Step J15.

CA8490-A

Electrical Schematic

5.0L EFI



NOTE: WIRING SCHEMATIC SHOWS PIN OUT LOOKING INTO HARNESS CONNECTOR

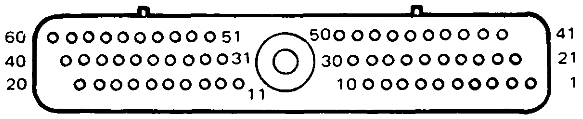
EEC-IV Module Connector Pin Usage

5.0L EFI

F-SERIES/BRONCO

Pin	Circuit	Wire Color	Application	Abbreviations
1	37	Y	Keep Alive Power	KAPWR
3	150	DG/W	Vehicle Speed Sensor +	VSS DIF +
4	11	DG/Y	Ignition Diagnostic Monitor	IDM
6	57	BK	Vehicle Speed Sensor −	VSS DIF −
7	354	LG/Y	Engine Coolant Temperature Sensor	ECT
10	347	BK/Y	A/C Cycling Switch	ACCS
11	200	W/BK	Air Management 2 (TAD)	AM-2
16	259	BK/O	Ignition Ground	IGN GND
17	201	T/R	Self-Test Output	STO
18	223	T/LG	Inferred Mileage Sensor	IMS
20	57	BK	Case Ground	CASE GND
21	67	GY/W	Idle Speed Control — Bypass Air	ISC — BPA
22	97	T/LG	Fuel Pump	FP
23	99	LG/BK	Knock Sensor	KS
24	330	Y/LG	Power Steering Pressure Switch	PSPS
25	310	Y/R	Air Charge Temperature Sensor	ACT
26	351	O/W	Reference Voltage	VREF
27	352	BR/LG	EGR Valve Position Sensor	EVP
29	94	DG/P	Heated Exhaust Oxygen Sensor	HEGO
30	481	GY/Y	Neutral Drive Switch	NDS
33	360	DG	EGR Vacuum Regulator (Solenoid)	EVR
36	324	Y/LG	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
40	60	BK/LG	Power Ground	PWR GND
45	356	DB/LG	Manifold Absolute Pressure	MAP
46	359	BK/W	Signal Return	SIG RTN
47	355	DG/LG	Throttle Position Sensor	TP
48	100	W/R	Self-Test Input	STI
49	89	O	Heated Exhaust Oxygen Ground	HEGOG
51	190	W/R	Air Management 1 (TAB)	AM-1
56	349	DB	Profile Ignition Pick-Up	PIP
57	361	R	Vehicle Power	VPWR
58	96	T/O	Injector Bank 1 (Controls Engine Cylinder Numbers 1, 4, 5 and 8)	INJ BANK 1
59	95	T/R	Injector Bank 2 (Controls Engine Cylinder Numbers 2, 3, 6 and 7)	INJ BANK 2
60	60	BK/LG	Power Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA8350-C

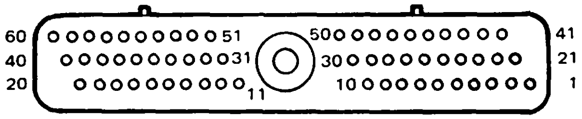
EEC-IV Module Connector Pin Usage

5.0L EFI

ECONOLINE

Pin	Circuit	Wire Color	Application	Abbreviations
1	38	BK/R	Keep Alive Power	KAPWR
3	145	BK	Vehicle Speed Sensor +	VSS DIF +
4	11	BK-Y	Ignition Diagnostic Monitor	IDM
6	146	BK	Vehicle Speed Sensor −	VSS DIF −
7	354	GR-Y	Engine Coolant Temperature Sensor	ECT
10	347	BK	A/C Cycling Switch	ACCS
11	200	BL	Air Management 2 (TAD)	AM 2
16	57	BK	Ignition Ground	IGN GND
17	201	BL-Y	Self-Test Output	STO
20	60	BK/W	Case Ground	CASE GND
21	67	GR/W	Idle Speed Control — Bypass Air	ISC-BPA
22	97	O	Fuel Pump	FP
23	99	BK	Knock Sensor	KS
24	331	R	Power Steering Pressure Switch	PSPS
25	310	R/BK	Air Charge Temperature Sensor	ACT
26	351	R	Reference Voltage	VREF
27	352	BR/GR	EGR Valve Position Sensor	EVP
29	94	GR/P	Heated Exhaust Gas Oxygen Sensor	HEGO
30	150	R	Neutral Drive Switch	NDS
33	360	Y/BL	EGR Vacuum Regulator (Solenoid)	EVR
36	324	Y/GR	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
40	60	BK/W	Power Ground	PWR GND
45	356	BL/GR	Manifold Absolute Pressure	MAP
46	359	BK/W	Signal Return	SIG RTN
47	355	GR	Throttle Position Sensor	TP
48	100	BK/R	Self-Test Input	STI
49	89	O	Heated Exhaust Gas Oxygen Ground	HEGOG
51	190	Y	Air Management I (TAB)	AM I
56	349	BR	Profile Ignition Pick-Up	PIP
57	361	R	Vehicle Power	VPWR
58	96	O/BK	Injector Bank 1 (Controls Engine Cyl. Nos. 1, 4, 5, and 8)	INJ BANK 1
59	95	W	Injector Bank 2 (Controls Engine Cyl. Nos. 2, 3, 6, and 7)	INJ BANK 2
60	60	BK/W	Power Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA9899-A

EEC-IV Diagnostic By Symptom

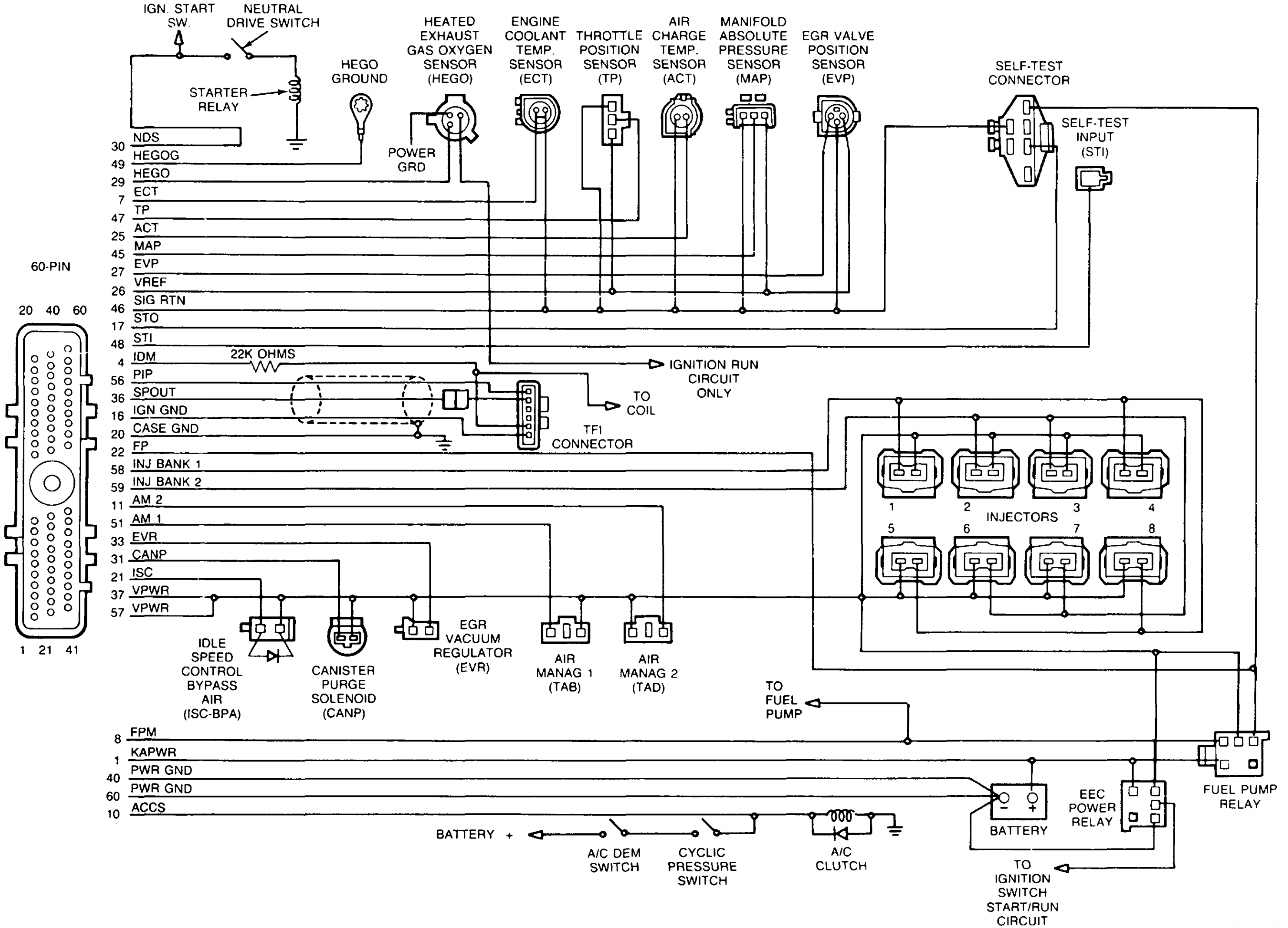
7.5L EFI

SYMPTOM	RESULT	ACTION TO TAKE
• Engine stalls. • Stalls in Self-Test. • Runs rough. • Misses.	Always rich/lean. ▶	• GO to Pinpoint Test Step S1. • Map test, GO to Pinpoint Test Step DF20. • Idle Speed Control, GO to Pinpoint Test Step KE1. • Poor power/ground connections. • Ignition system distributor cap, rotor, wires, coil, plugs. • Base engine valves, cam timing, compression etc.
• Low idle rpm with A/C On.		GO to Pinpoint Test Step FA20.
• Shift indicator light always On or Off.		GO to Pinpoint Test Step KL1.
• A/C does not cut-off under WOT conditions.		GO to Pinpoint Test Step KM1.
• Surges with A/C on at idle.		GO to Pinpoint Test Step KM20.
• Stumble after hot re-start (HEGO).		GO to Pinpoint Test Step HH21.
• Fuel pump runs with Key Off.		GO to Pinpoint Test Step J15.
• Gasoline fumes under hood.		GO to Pinpoint Test Step KD1.

CA9986-A

Electrical Schematic

7.5L EFI



NOTE: WIRING SCHEMATIC SHOWS PIN OUT LOOKING INTO HARNESS CONNECTOR

A9987-A

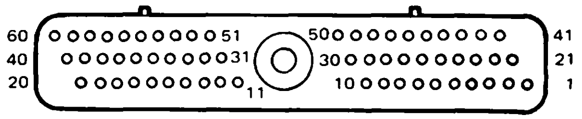
EEC-IV Module Connector Pin Usage

7.5L EFI

F-SERIES/BRONCO

Pin	Circuit	Wire Color	Application	Abbreviations
1	37	Y	Keep Alive Power	KAPWR
4	11	DG/Y	Ignition Diagnostic Monitor	IDM
7	354	LG/Y	Engine Coolant Temperature Sensor	ECT
8	276	BR	Fuel Pump Monitor	FPM
10	347	BK/Y	A/C Cycling Switch	ACCS
11	200	W/BK	Air Management 2 (TAD)	AM-2
16	259	BK/O	Ignition Ground	IGN GND
17	201	T/R	Self-Test Output	STO
20	57	BK	Case Ground	CASE GND
21	67	GY/W	Idle Speed Control — Bypass Air	ISC — BPA
22	97	T/LG	Fuel Pump	FP
25	310	Y/R	Air Charge Temperature Sensor	ACT
26	351	O/W	Reference Voltage	VREF
27	352	BR/LG	EGR Valve Position Sensor	EVP
29	94	DG/P	Heated Exhaust Oxygen Sensor	HEGO
30	481	GY/Y	Neutral Drive Switch	NDS
31	101	GY/Y	Canister Purge	CANP
33	360	DG	EGR Vacuum Regulator (Solenoid)	EVR
36	324	Y/LG	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
40	60	BK/LG	Power Ground	PWR GND
45	356	DB/LG	Manifold Absolute Pressure	MAP
46	359	BK/W	Signal Return	SIG RTN
47	355	DG/LG	Throttle Position Sensor	TP
48	100	W/R	Self-Test Input	STI
49	89	O	Heated Exhaust Oxygen Ground	HEGOG
51	190	W/R	Air Management 1 (TAB)	AM-1
56	349	DB	Profile Ignition Pick-Up	PIP
57	361	R	Vehicle Power	VPWR
58	96	T/O	Injector Bank 1 (Controls Engine Cylinder Numbers 1, 4, 5 and 8)	INJ BANK 1
59	95	T/R	Injector Bank 2 (Controls Engine Cylinder Numbers 2, 3, 6 and 7)	INJ BANK 2
60	60	BK/LG	Power Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA9988-A

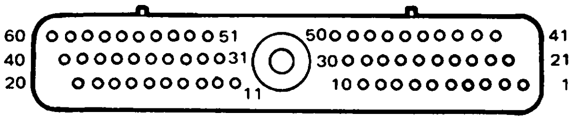
EEC-IV Module Connector Pin Usage

7.5L EFI

ECONOLINE

Pin	Circuit	Wire Color	Application	Abbreviations
1	38	BK/R	Keep Alive Power	KAPWR
4	11	BK/Y	Ignition Diagnostic Monitor	IDM
7	354	GR/Y	Engine Coolant Temperature Sensor	ECT
8	787	R/BR	Fuel Pump Monitor	FPM
10	347	BK	A/C Cycling Switch	ACCS
11	200	BL	Air Management 2 (TAD)	AM 2
16	57	BK	Ignition Ground	IGN GND
17	201	BL/Y	Self-Test Output	STO
20	60	BK/W	Case Ground	CASE GND
21	67	GR/W	Idle Speed Control — Bypass Air	ISC-BPA
22	97	O	Fuel Pump	FP
25	310	R/BK	Air Charge Temperature Sensor	ACT
26	351	R	Reference Voltage	VREF
27	352	BR/GR	EGR Valve Position Sensor	EVP
29	94	GR/P	Heated Exhaust Gas Oxygen Sensor	HEGO
30	150	R	Neutral Drive Switch	NDS
31	101	GY	Canister Purge	CANP
33	360	Y/BL	EGR Vacuum Regulator (Solenoid)	EVR
36	324	Y/GR	Spark Output	SPOUT
37	361	R	Vehicle Power	VPWR
40	60	BK/W	Power Ground	PWR GND
45	356	BL/GR	Manifold Absolute Pressure	MAP
46	359	BK/W	Signal Return	SIG RTN
47	355	GR	Throttle Position Sensor	TP
48	100	BK/R	Self-Test Input	STI
49	89	O	Heated Exhaust Gas Oxygen Ground	HEGOG
51	190	Y	Air Management I (TAB)	AM I
56	349	BR	Profile Ignition Pick-Up	PIP
57	361	R	Vehicle Power	VPWR
58	96	O/BK	Injector Bank 1 (Controls Engine Cyl. Nos. 1, 4, 5, and 8)	INJ BANK 1
59	95	W	Injector Bank 2 (Controls Engine Cyl. Nos. 2, 3, 6, and 7)	INJ BANK 2
60	60	BK/W	Power Ground	PWR GND

Pin locations given for reference only. Probing 60 pin connector with DVOM probe will result in permanent damage to the pin connectors. Always probe as directed, using the Breakout Box.



CA9989-A

OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS

ORDERING INFORMATION
A special order form is included in the back of this manual for your convenience if you desire to order.

ENGINE EMISSIONS FACTS BOOK

- The manual contains complete specifications for each calibration number.
- Published at the conclusion of the model year.

ELECTRICAL & VACUUM TROUBLESHOOTING MANUAL (EVTM)

- Available for all passenger car and light truck vehicles, this publication provides schematics of all electrical and vacuum circuits. Wiring diagrams show how the circuit is powered. Troubleshooting hints are provided to point the technician in a general direction but are not step by step procedures.
- Available in the first quarter of the model year. (One manual for each passenger car and light truck family.)

WIRING & VACUUM DIAGRAMS

- This publication contains wiring diagrams for all Ford and Lincoln/Mercury passenger car and light truck vehicles. A Power Distribution system illustrates the power distribution throughout each vehicle. In addition, all individual electrical circuits are shown for each vehicle line.
- Available in the first quarter of the model year.

Service Specifications Manuals

(CAR AND TRUCK)

- These manuals contain all specifications including maintenance and lubrication contained in the Shop Manuals in a handy pocket size for easy reference.
- Available in the first quarter of the model year.

SECTION 19

EEC IV—Pinpoint Tests—All Vehicles

Contents

Instructions for Using the Pinpoint Tests 19-1

Pinpoint Test Index 19-2

Pinpoint Tests

INSTRUCTIONS FOR USING THE PINPOINT TESTS

- Do not run any of the following Pinpoint Tests unless you are so instructed by the Quick Test. Each Pinpoint Test assumes that a fault has been detected in the system with direction to enter a specific repair routine. Doing any Pinpoint Test without direction from Quick Test may produce incorrect results and replacement of Non-Defective components.
- Correct test results for Quick Test are dependent on the proper operation of related non-EEC components/systems. It may be necessary to correct any defects in these areas before EEC will pass the Quick Test. Refer to the Diagnostic Routines, Section 2 for service.
- Do not replace any parts unless the test result indicates they should be replaced.
- When more than one service code is received, always start service with the first code received.
- Do not measure voltage or resistance at the processor or connect any test lights to it, unless otherwise specified.
- Isolate both ends of a circuit, and turn key Off whenever checking for shorts or continuity, unless specified.
- Disconnect solenoids and switches from the harness before measuring for continuity, resistance, or energizing by way of 12-volt source.
- In using the Pinpoint Tests, follow each Step in order, starting from the first Step in the appropriate test. Follow each Step until the fault is found.
- After completing any repairs to the EEC system, verify all components are properly reconnected and repeat the functional test (Retest).
- An open is defined as any resistance reading greater than 5 ohms unless otherwise specified.
- A short is defined as any resistance reading less than 10,000 ohms to ground, unless otherwise specified.

The standard Ford color abbreviations are:

BK	**Black**	**N**	**Natural**
BL	**Blue**	**O**	**Orange**
BR	**Brown**	**PK**	**Pink**
DB	**Dark Blue**	**P**	**Purple**
DG	**Dark Green**	**R**	**Red**
GY	**Gray**	**T**	**Tan**
GR	**Green**	**W**	**White**
LB	**Light Blue**	**Y**	**Yellow**
LG	**Light Green**		

Where two colors are shown for a wire, the first color is the basic color of the wire. The second color is the dot, hash, or stripe marking. If **D** or **H** is given, the second color is dots or hash marks. If there is no letter after the second color, the wire has a stripe.

For example:

BR/O is a brown wire with an orange stripe.

R/Y D is a red wire with yellow dots.

BK/W H is a black wire with white hash marks.

Pinpoint Test Index

PINPOINT TEST LETTER	PINPOINT TEST TITLE	PAGE NUMBER
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DL	Pressure Feedback EGR (PFE) EGR Valve Regulator (EVR)	19-70
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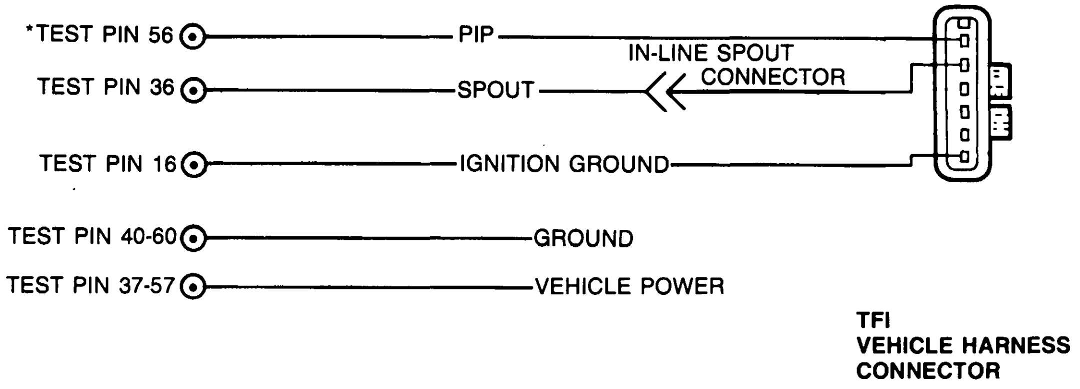
EEC-IV No Start

Pinpoint Test

A

A



*TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

NOTE: WHEN BREAKOUT BOX IS INSTALLED, ENSURE THAT TIMING SWITCH IS IN "COMPUTED" POSITION UNLESS OTHERWISE NOTED.

A9576-A

STOP-WARNING

You should enter this Pinpoint Test only when Steps 1.0 through 3.0 have been successfully completed and the engine is still a no start, or when directed here from Pinpoint Test P. This Pinpoint Test will not diagnose ignition system problems.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Fuel: quantity and quality
- Ignition: general condition, moisture, cracks, damage, etc.
- Engine: internal, valves, timing belt, camshaft.
- Starter and battery circuit

This Pinpoint Test is intended to diagnose only the following:

- Spark (as related to EEC-IV).
- Circuits: pip, spout, ignition ground, vehicle power.

EEC-IV No Start

Pinpoint Test A

WARNING: Stop this test at the first sign of a fuel leak and service as required.
CAUTION: No open flame — No smoking during fuel delivery checks.

TEST STEP	RESULT ▶	ACTION TO TAKE
A1 ATTEMPT TO START ENGINE	Engine cranks, but does not start, or stalls out ▶	GO to A2.
	Engine does not crank ▶	REFER to Shop Manual, Group 28.
A2 CHECK FOR VREF AT THROTTLE POSITION SENSOR o Key Off, wait 10 seconds. o DVOM on 20V scale. o Disconnect TP sensor. o Key On, Engine Off. o Measure voltage at the TP vehicle harness connector between VREF and signal return. **NOTE: Refer to electrical schematic in appropriate engine supplement section for connector pin orientation.**	Less than 4.0V or greater than 6.0V ▶	GO to Pinpoint Test Step C1.
	4.0V to 6.0V ▶	RECONNECT TP sensor. GO to A3.
A3 CHECK FOR SPARK AT PLUGS o Disconnect the spark plug wire to any accessible cylinder. o Connect spark tester between spark plug wire and engine ground. o Crank engine and check for spark. o Reconnect the spark plug wire to the spark plug.	Spark ▶	GO to A13.
	No spark ▶	GO to A4.
A4 CHECK FOR SPARK AT COIL o Remove high tension coil wire from distributor and install spark tester. o Check for spark while cranking. o Reconnect high tension coil wire to distributor.	Spark ▶	REFER to Section 15, Part 2 for TFI Diagnosis for cap, rotor, wires.
	No spark ▶	GO to A5.

EEC-IV No Start

Pinpoint Test A

TEST STEP	RESULT ▶	ACTION TO TAKE
A5 HARNESS CHECK (IGNITION GROUND)		
• Key Off, wait 10 seconds. • Install Breakout box. Leave processor disconnected. • DVOM on 200 ohm scale. • Disconnect TFI. • Measure resistance between test Pin 16 at the Breakout box and TFI harness connector ignition ground.	Less than 5 ohms ▶ 5 ohms or greater ▶	GO to **A6**. SERVICE harness as necessary. RERUN Quick Test.
A6 ISOLATION OF PROBLEM TO SPOUT CIRCUIT		
• Breakout box installed. • Connect TFI. • Connect processor. • Timing switch to "Dist" position on Breakout box. • Attempt to start vehicle. • Does the vehicle start?	Yes ▶ No ▶	GO to **A10**. GO to **A7**.
A7 SPOUT SIGNAL CHECK		
• Breakout box installed. • Timing switch to "Computed" position on Breakout box. • DVOM on 20V scale. • Measure voltage between test Pin 36 at the Breakout box and chassis ground, during crank.	Less than 3.0V or greater than 6.0V ▶ Between 3.0V and 6.0V ▶	GO to **A8**. EEC OK, REFER to Section 15, for TFI diagnosis.
A8 CHECK SPOUT FOR SHORTS		
• Key Off, wait 10 seconds. • Breakout box installed. • Disconnect processor. • Disconnect TFI. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 36 and test Pins 16, 20, 26, 40, 60 (short to ground), 37, 57 (short to power) and 56 (short to pip) at the Breakout box.	All readings 10,000 ohms or greater ▶ Any reading less than 10,000 ohms ▶	GO to **A9**. SERVICE short in harness. RERUN Quick Test if vehicle does not start. GO to **A9**.

EEC-IV No Start

Pinpoint Test

A

TEST STEP	RESULT ▶	ACTION TO TAKE
A9 ISOLATE SHORT(S) IN PROCESSOR		
o Key Off, wait 10 seconds. o Breakout box installed. o Reconnect processor. o TFI disconnected. o DVOM on 200 ohm scale. o Measure resistance between test Pin 36 and test Pins 37 and 57 (short to power) also, test Pins 40 and 60 (short to ground) at the Breakout box.	All readings 5.0 ohms or greater. ▶ Any reading less than 5.0 ohms ▶	Connect TFI. GO to A10. REPLACE processor. RERUN Quick Test.
A10 PIP SIGNAL CHECK		
o Breakout box installed. o DVOM to 20V scale. o Measure voltage between test Pin 56 and test Pin 16 at the Breakout box. o Crank engine, record reading.	Between 3.0V and 6.0V ▶ Less than 3.0V or greater than 6.0V ▶	REMOVE Breakout box. REPLACE processor. RERUN Quick Test. GO to A11.
A11 CONTINUITY OF PIP CIRCUIT CHECK		
o Breakout box installed. o Key Off, wait 10 seconds. o DVOM on 200 ohm scale. o Disconnect TFI. o Disconnect processor. o Measure resistance between test Pin 56 at the Breakout box and TFI harness connector PIP circuit.	Less than 5 ohms ▶ 5 ohms or greater ▶	GO to A12. SERVICE open PIP circuit. RERUN Quick Test.

EEC-IV No Start

Pinpoint Test A

TEST STEP	RESULT ▶	ACTION TO TAKE
A12 CHECK PIP CIRCUIT FOR SHORTS		
• Breakout box installed. • Processor disconnected. • Key Off. • Disconnect TFI connector. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 56 and test Pins 16, 20, 26, 40, 60 (shorts to ground) and test Pins 37 and 57 (shorts to power) and test Pin 36 (short to spout) at the Breakout box.	Any resistance less than 10,000 ohms ▶	SERVICE PIP circuit. RERUN Quick Test.
	All resistance greater than 10,000 ohms ▶	REFER to Section 15 for TFI diagnosis.
A13 SPOUT SIGNAL VERIFICATION		
• Key Off, wait 10 seconds. • Disconnect processors 60 pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box. • Processor connected. • DVOM on 20V scale. • Measure voltage between test Pin 36 at the Breakout box and chassis ground, during crank. • Ensure timing switch is in "Computed" position on Breakout box.	Between 3.0V and 6.0V ▶	GO to **A21**.
	Less than 3.0V or greater than 6.0V ▶	GO to **A10**.

EEC-IV
No Start

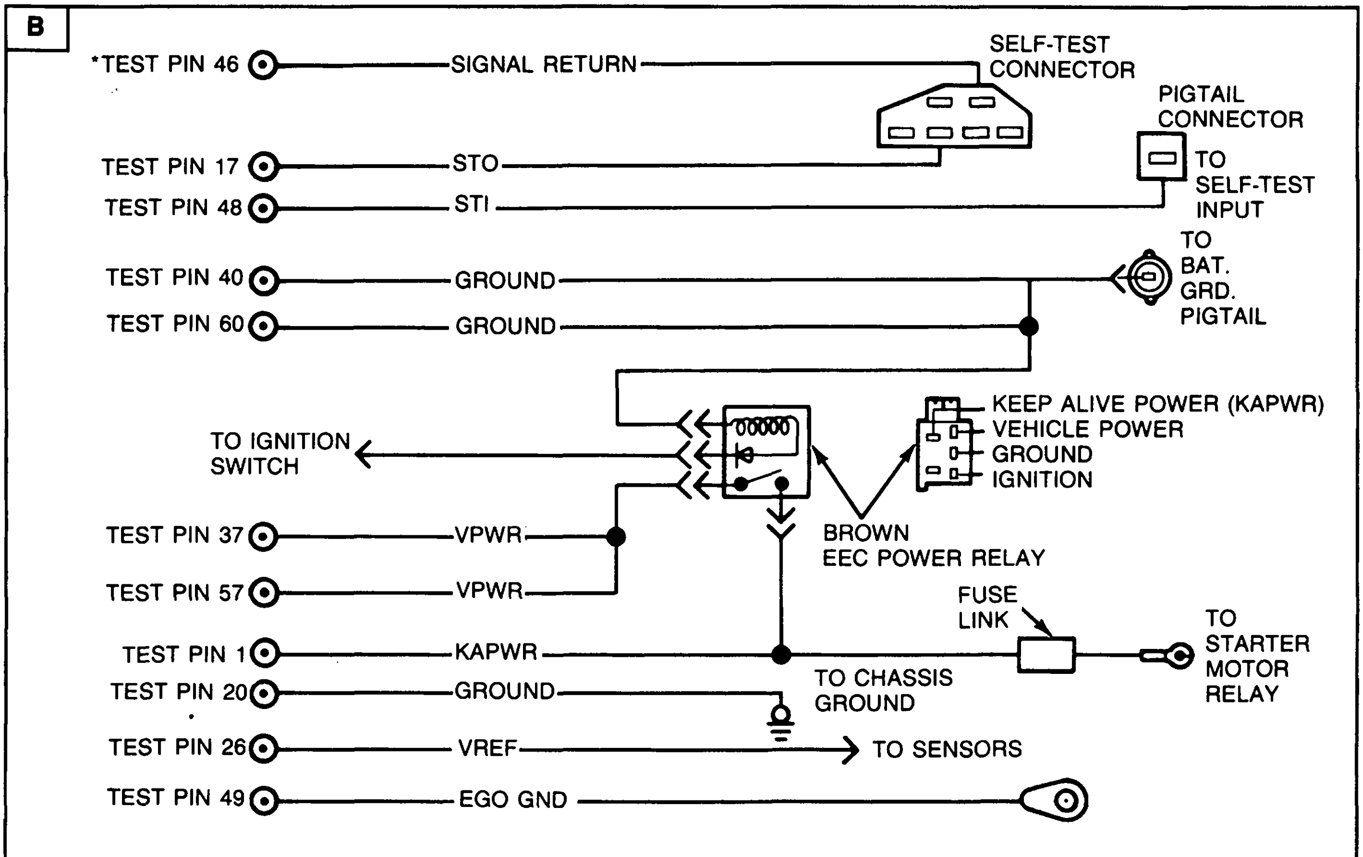
Pinpoint Test A

TEST STEP	RESULT ▶	ACTION TO TAKE
A21 FUEL PUMP CHECK		
• **No smoking nearby.** • Connect pressure gauge. • Note initial pressure reading. • Observe pressure gauge as you pressurize fuel system. (Turn key to RUN for 1 second, then turn key to OFF. Wait 10 seconds. Repeat 5 times.)	PRESSURE GAUGE READING:	
	Increased ▶	All EFI Go to Pinpoint Test Step S1. All CFI Go to Pinpoint Test Step S2.
	Did not increase ▶	TURN key Off, and CONTINUE to A22.
WARNING: If fuel starts leaking, turn key OFF immediately. No smoking.		
A22 INERTIA SWITCH CHECK		
• Key Off. • Fuel pressure gauge installed. • Locate fuel pump inertia switch. Refer to Owner's Manual for location. • Push the button of inertia switch to reset to ON. **NOTE: If switch will not reset to ON, replace Inertia Switch and repeat Step A21. If switch button was on, GO to Step J1, except 2.5L HSC CFI and 3.0L EFI passenger car, GO to Step X-11.** • Observe pressure gauge as you pressurize fuel system. (Turn key to RUN for 1 second, then turn key to OFF. Wait 10 seconds.) Repeat 5 times.	PRESSURE GAUGE READING:	
	Increase ▶	RERUN Quick Test.
	No increase ▶	• 2.3L EFI TC 2.5L HSC-CFI and 3.0L EFI passenger car GO to X-11. • All others, GO to J1.

Vehicle Battery

Pinpoint Test

B



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9577-B

STOP-WARNING

You should enter this Pinpoint Test only when directed here from Pinpoint Tests C, J or P or when a continuous memory code 72 or 78 is received in Quick Test Step 6.0C.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Ignition switch.
- Battery Cables.
- Alternator.
- Voltage Regulator.
- Ground Straps.

This pinpoint test is intended to diagnose only the following:

- Processor.
- Harness circuits: Signal Return, STO, STI, Ground, VPWR, KAPWR, VREF, Ignition.
- Battery Voltage.
- Power Relay.

Vehicle Battery

Pinpoint Test

B

TEST STEP	RESULT ▶	ACTION TO TAKE
B1 BATTERY VOLTAGE CHECK		
o Key On, Engine Off. o DVOM on 20V scale. o Measure voltage across battery terminals. o Is voltage reading 10.5 volts or greater?	Yes ▶ No ▶	GO to B2. SERVICE discharged battery, REFER to Shop Manual, Group 31.
B2 EEC GROUND TO BATTERY GROUND CHECK		
o Key Off, wait 10 seconds. o Install Breakout box. o Processor connected. o DVOM on 200 ohm scale. o Measure resistance between test Pin 40 and negative post of the battery and test Pin 60 and negative post of the battery. o Are both resistance readings less than 5 ohms?	Yes ▶ No ▶	GO to B3. CORRECT cause of resistance between negative side and Pin 40, or 60 of the EEC system. RERUN Quick Test.
B3 PROCESSOR GROUND FAULT ISOLATION		
o Breakout box installed. o Key Off, wait 10 seconds. o Processor connected. o DVOM on 200 ohm scale. o Measure resistance between test Pin 46 and test Pin 40 and between test Pin 46 and test Pin 60 both at the Breakout box. o Are both resistance readings 5 ohms or less?	Yes ▶ No ▶	GO to B4. DISCONNECT processor connector and INSPECT for corrosion, damaged pins, etc. SERVICE as necessary and RETEST. If fault is still present, REPLACE processor. RERUN Quick Test.
B4 HARNESS CHECK (SIGNAL RETURN)		
o Breakout box installed. o Key Off, wait 10 seconds. o Processor connected. o DVOM on 200 ohm scale. o Measure resistance between test Pin 46 at the Breakout box and Signal Return in the Self-Test connector. o Is resistance reading less than 5.0 ohms?	Yes ▶ No ▶	GO to B5. CORRECT cause of resistance in the harness Signal Return circuit. RERUN Quick Test.

Vehicle Battery

Pinpoint Test

B

TEST STEP	RESULT ▶	ACTION TO TAKE
B5 12 VOLT BATTERY POWER FAULT ISOLATION		
• Key On, Engine Off. • Processor connected. • DVOM on 20V scale. • Measure voltage between the battery negative post and KAPWR circuit (Test Pin 1) at EEC power relay. • Is voltage reading 10.5V or greater?	Yes ▶ No ▶	GO to B6. CHECK KAPWR and VPWR circuits for shorts to ground and KAPWR circuit from power relay to battery positive post for opens. SERVICE as necessary. RERUN Quick Test.
B6 12 VOLT BATTERY POWER FAULT ISOLATION		
• Key On, Engine Off. • Processor connected. • DVOM on 20V scale. • Measure voltage between the battery negative post and Ignition circuit at EEC power relay. • Is the reading 10.5 volts or greater?	Yes ▶ No ▶	GO to B7. CHECK for open in ignition switch circuits. SERVICE as necessary. RERUN Quick Test.
B7 12 VOLT BATTERY POWER FAULT ISOLATION		
• Key Off, wait 10 seconds. • Processor connected. • DVOM on 200 ohm scale. • Measure resistance between ground at the EEC power relay and negative post of battery. • Is the resistance reading 5 ohms or less?	Yes ▶ No ▶	GO to B8. SERVICE open or ground in Ground Circuit. RERUN Quick Test.
B8 12 VOLT BATTERY POWER FAULT ISOLATION		
• Key On, Engine Off. • Processor connected. • DVOM on 20V scale. • Measure voltage between the battery negative post and VPWR circuit at EEC power relay. • Is the voltage reading 10.5 volts or greater?	Yes ▶ No ▶	SERVICE open in VPWR circuit, if OK, SERVICE short to ground in VPWR circuit. REPLACE power relay. RERUN Quick Test.

Vehicle Battery | Pinpoint Test | B

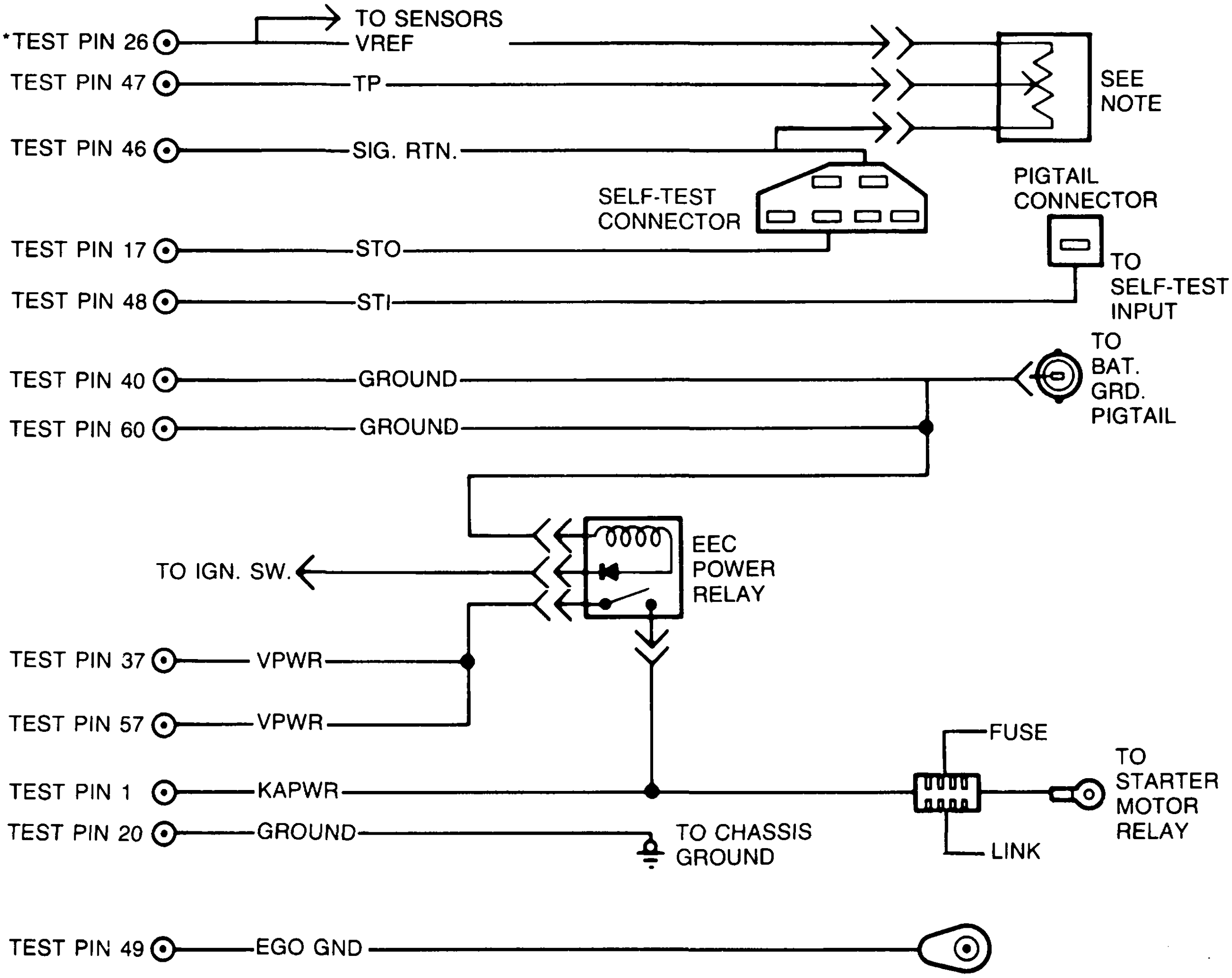
TEST STEP	RESULT ▶	ACTION TO TAKE
B10 WIGGLE TEST VPWR CIRCUITS		
• Key On, Engine Off. • STAR tester or VOM hooked up to Self-Test connector. • Self-Test deactivated. • Observe STAR/VOM for fault indication as explained in Quick Test Step 6.0D. • Shake, bend and twist the EEC-IV harness from the EEC time delay power relay to the processor. • Is a fault indicated or does code 72 or 78 reappear in continuous memory if Quick Test is rerun?	Yes ▶	SERVICE intermittent VPWR circuit. RERUN Quick Test.
	No ▶	INSPECT EEC-IV time delay power relay and harness connectors for damaged pins, corrosion, etc. SERVICE as necessary. If OK, REPLACE EEC-IV time delay relay. RERUN Quick Test.

Reference Voltage

Pinpoint Test

C

C



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9578-B

NOTE: Refer to the electrical schematic in the appropriate engine supplement section for proper connector and pin orientation.

STOP-WARNING

You should enter this Pinpoint Test only when a check for Vref has failed in the sensor Pinpoint Tests (D-Series) or Pinpoint Tests A or Q.

This pinpoint test is intended to diagnose only the following:

- Processor.
- Sensor harness circuits: Signal Return, STO, STI, Ground, VPWR, KAPWR, VREF, Ignition.

Reference Voltage

Pinpoint Test

C

TEST STEP	RESULT ▶	ACTION TO TAKE
C1 VEHICLE BATTERY POWER CIRCUIT CHECK		
○ Disconnect 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. ○ Breakout box installed. ○ Processor connected. ○ Key On, Engine Off. ○ DVOM on 20V scale. ○ Measure voltage between test Pin 37 at the Breakout box and Signal Return in Self-Test connector. ○ Is voltage 10.5 volts or greater?	Yes ▶	GO to C2.
	No ▶	2.3L EFI TC, 2.5L HSC CFI and 3.0L EFI passenger car GO to X-1. All others, GO to B1.
C2 VREF VOLTAGE CHECK		
○ Breakout box installed. ○ Key On, Engine Off. ○ Processor connected. ○ DVOM on 20V scale. ○ Measure voltage between test Pin 26 and test Pin 46 at the Breakout box.	6.0V or greater ▶	GO to C4.
	4.0V or less ▶	GO to C5.
	Greater than 4.0V, less than 6.0V ▶	GO to C3.
C3 CHECK VREF AND SIGNAL RETURN FOR CONTINUITY		
○ Breakout box installed. ○ Processor disconnected. ○ Sensor that sent you here disconnected. ○ Key Off. ○ DVOM on 200 ohm scale. ○ Measure resistance from test Pin 26 at Breakout box to VREF at vehicle harness connector of the sensor that sent you here. ○ Measure resistance from test Pin 46 at Breakout box to signal return at vehicle harness connector of the sensor that sent you here. ○ Are both resistance readings less than 5.0 ohms?	Yes ▶	RECONNECT sensors. Reference voltage OK. RERUN Quick Test.
	No ▶	SERVICE open in Vref or Signal Return. RERUN Quick Test.

Reference Voltage

Pinpoint Test C

TEST STEP	RESULT ▶	ACTION TO TAKE
C4 CHECK FOR SHORT FROM VREF TO VPWR		
• Key Off, wait 10 seconds. • Breakout box installed. • Disconnect processor. • Key On, Engine Off. • DVOM on 20V scale. • Measure voltage between test Pin 26 at the Breakout box and battery ground. • Is voltage less than 0.5 volts?	Yes ▶	REPLACE processor. RERUN Quick Test.
	No ▶	SERVICE short to battery power in EEC harness. RERUN Quick Test. If condition persists, REPLACE processor.
C5 CHECK FOR SHORTED THROTTLE POSITION SENSOR		
• Key Off, wait 10 seconds. • Breakout box installed. • Processor connected. • Disconnect Throttle Position (TP) sensor from vehicle harness. • Key On, Engine Off. • DVOM on 20V scale. • Measure voltage between test Pin 26 and test Pin 46 at the Breakout box. • Is voltage less than 4.0 volts?	Yes ▶	Vehicles equipped with EVP/PFE sensor, GO to C6. All other vehicles, GO to C7.
	No ▶	REPLACE TP sensor. RERUN Quick Test.
C6 CHECK FOR SHORTED EVP/PFE SENSOR		
• Key Off, wait 10 seconds. • Breakout box installed. • Processor connected. • Disconnect EVP/PFE sensor. • Key On, Engine Off. • DVOM on 20V scale. • Measure voltage between test Pin 26 and test Pin 46 at the Breakout box. • Is voltage less than 4.0 volts?	Yes ▶	GO to C7.
	No ▶	REPLACE EVP/PFE sensor. RERUN Quick Test.

Reference Voltage | Pinpoint Test | C

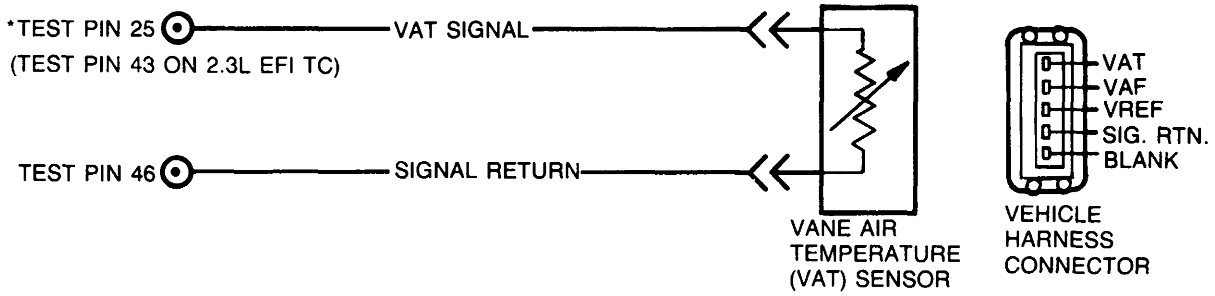
TEST STEP	RESULT ▶	ACTION TO TAKE
C7 CHECK FOR SHORTED MAP/BP SENSOR		
• Key Off, wait 10 seconds. • Breakout box installed. • Processor connected. • Disconnect MAP/BP sensor. • Key On, Engine Off. • DVOM on 20V scale. • Measure voltage between test Pin 26 and test Pin 46 at the Breakout box. • Is reading less than 4.0 volts?	Yes ▶	Vehicles equipped with VAF sensor, GO to **C8**. All other vehicles, GO to **C9**.
	No ▶	REPLACE MAP/BP sensor. RERUN Quick Test.
C8 CHECK FOR SHORTED VANE AIR METER (VAF) SENSOR		
• Key Off, wait 10 seconds. • Breakout box installed. • Processor connected. • Disconnect vane air meter (VAF) sensor. • Key On, Engine Off. • DVOM on 20V scale. • Measure voltage between test Pin 26 and test Pin 46 at the Breakout box. • Is voltage less than 4.0 volts?	Yes ▶	GO to **C9**.
	No ▶	REPLACE VAF sensor and RERUN Quick Test.
C9 SHORT TO GROUND IN VREF		
• Breakout box installed. • Processor disconnected. • Key Off, wait 10 seconds. • Disconnect TP and MAP/BP, EVP/PFE and VAF, if so equipped. • DVOM on 200 ohm scale. • Measure resistance between test Pin 26 and test Pins 20, 40, 46 and 60 at the Breakout box. • Is any resistance less than 5 ohms?	Yes ▶	SERVICE short to ground. CONNECT all sensors. RERUN Quick Test. If original condition still exists, REPLACE processor.
	No ▶	RECONNECT sensors. REPLACE processor. RERUN Quick Test.

Vane Air Temperature Sensor (VAT)

Pinpoint Test

DA

DA


*TEST PIN 25
(TEST PIN 43 ON 2.3L EFI TC)
VAT SIGNAL
TEST PIN 46
SIGNAL RETURN
VANE AIR TEMPERATURE (VAT) SENSOR
VAT
VAF
VREF
SIG. RTN.
BLANK
VEHICLE HARNESS CONNECTOR

NOTE: AMBIENT TEMPERATURE MUST BE GREATER THAN 50°F TO PASS THIS TEST.

TYPICAL RESISTANCE BETWEEN TEST PINS 25 (OR 43) & 46	5800 ohms	2700 ohms	300 ohms	180 ohms	125 ohms
AT TEMPERATURE	32°F	65°F	185°F	220°F	240°F

***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9579-B

STOP-WARNING

You should enter this Pinpoint Test only when a service code 28, 58 or 68 is received in Quick Test Step 3.0, 5.0 or 6.0.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Test performed in unusually low (cold) or high (hot) ambient conditions.
- Ambient temperature must be greater than 50°F for this test.

This pinpoint test is intended to diagnose only the following:

- VAT sensor.
- Circuits: VAT, and Signal Return.
- Vehicle harness.
- Processor assembly.

Vane Air Temperature Sensor (VAT)

Pinpoint Test

DA

TEST STEP	RESULT ▶	ACTION TO TAKE
DA1 SERVICE CODE 28: CHECK AMBIENT TEMPERATURE		
• Is ambient temperature greater than 50°F?	Yes ▶	GO to DA2.
	No ▶	RERUN Quick Test.
DA2 CHECK FOR V REF AT THROTTLE POSITION SENSOR		
• Refer to illustration Q. • Key Off, wait 10 seconds. • DVOM on 20V scale. • Disconnect TP sensor. • Key On, Engine Off. • Measure voltage at the TP vehicle harness connector between VREF and signal return. • Is voltage between 4.0 volts and 6.0 volts?	Yes ▶	RECONNECT TP sensor, GO to DA3.
	No ▶	GO to Pinpoint Test Step C1.
DA3 VAT SENSOR CHECK		
NOTE: Ambient temperature must be greater than 50°F for this test. • Key Off, wait 10 seconds. • Harness disconnected from the vane meter. • DVOM on 200,000 ohm scale. • Measure resistance at the VAT sensor between VAT signal and Signal Return. • Is resistance from 125 ohms (240°F) to 3700 ohms (50°F)?	Yes ▶	REPLACE processor. RECONNECT harness to vane meter. RERUN Quick Test.
	No ▶	REPLACE vane meter. RERUN Quick Test.

Vane Air Temperature Sensor (VAT)

Pinpoint Test

DA

TEST STEP		RESULT ▶	ACTION TO TAKE
DA10	SERVICE CODE 58: INDUCE OPPOSITE CODE		
	• Key Off, wait 10 seconds. • Disconnect vehicle harness from vane meter. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Insert a jumper wire (paper clip) at the vane meter vehicle harness connector between VAT Signal and Signal Return. • Run Key On Engine Off Quick Test. • Is Code 68 present?	Yes ▶	REPLACE vane meter. REMOVE jumper wire. CONNECT harness to vane meter. RERUN Quick Test.
		No ▶	REMOVE jumper wire. GO to DA11.
DA11	CHECK CONTINUITY OF VAT SIGNAL AND SIGNAL RETURN		
	• Key Off, wait 10 seconds. • Harness disconnected from vane meter, jumper wire removed. • Disconnect processor 60 pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Install Breakout box leaving processor disconnected. • DVOM on 200 ohm scale. • Measure resistance between VAT signal at the vane meter vehicle harness connector, and test Pin 25 at the Breakout box. • Measure resistance between VAT signal at the vane meter vehicle harness connector, and test Pin 25 (test Pin 43 on 2.3L EFI TC) at the Breakout box. • Measure resistance between signal return at the vane meter vehicle harness connector, and test Pin 46 at the Breakout box. • Are both resistances less than 5 ohms?	Yes ▶	REPLACE processor. REMOVE Breakout box. RECONNECT harness to vane meter and processor. RERUN Quick Test.
		No ▶	CORRECT open circuit. REMOVE Breakout box. RECONNECT harness to vane meter and processor. RERUN Quick Test.

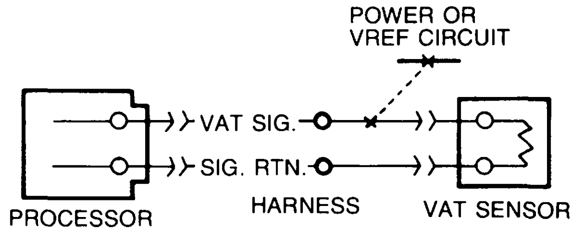
Vane Air Temperature Sensor (VAT) | Pinpoint Test | DA

TEST STEP	RESULT ►	ACTION TO TAKE
DA20 SERVICE CODE 68: INDUCE OPPOSITE CODE		
• Key off, wait 10 seconds. • Disconnect vehicle harness from vane meter. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Run Key On Engine Off Quick Test. • Is code 58 present?	Yes ►	REPLACE vane meter. RECONNECT harness to vane meter. RERUN Quick Test.
	No ►	GO to DA21.
DA21 CHECK FOR V REF AT THROTTLE POSITION SENSOR		
• Refer to illustration Q. • Key Off, wait 10 seconds. • DVOM on 20V scale. • Disconnect TP sensor. • Key On, Engine Off. • Measure voltage at the TP vehicle harness connector between VREF and signal return. • Is voltage between 4.0 volts and 6.0 volts?	Yes ►	RECONNECT TP sensor, GO to DA22.
	No ►	GO to Pinpoint Test Step C1.
DA22 CHECK VAT SIGNAL FOR SHORTS		
• Key Off, wait 10 seconds. • Harness disconnected from vane meter. • Disconnect processor 60 pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Install Breakout box leaving processor disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 25 (test Pin 43 on 2.3L EFI TC) and test Pins 40, 46 and 60 at the Breakout box. • Are all resistances greater than 10,000 ohms?	Yes ►	REPLACE processor. REMOVE Breakout box. RECONNECT processor. RERUN Quick Test.
	No ►	CORRECT circuit shorts. REMOVE Breakout box. RECONNECT processor and vane meter. RERUN Quick Test.

Vane Air Temperature Sensor (VAT)

Pinpoint Test

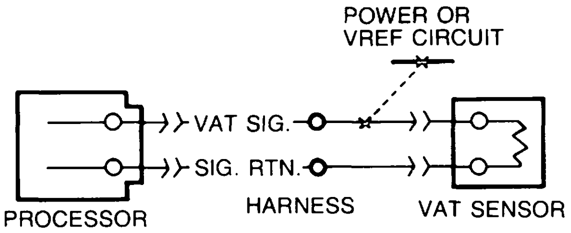
DA

TEST STEP	RESULT ▶	ACTION TO TAKE
DA90 SERVICE CODE 58: CONTINUOUS TEST: CHECK VAT SENSOR		
• Using continuous monitor mode, observe VOM or STAR LED for indication of a fault while performing the following: • Lightly tap on VAT sensor (simulate road shock). • Wiggle VAT connector. • Is a fault indicated?	Yes ▶	DISCONNECT and INSPECT connectors. If connector and terminals are good, REPLACE VAT sensor. RERUN Quick Test.
 POWER OR VREF CIRCUIT VAT SIG. SIG. RTN. PROCESSOR HARNESS VAT SENSOR A9580-A	No ▶	GO to **DA91**.
DA91 CHECK EEC-IV HARNESS		
• Observe VOM or STAR LED for a fault indication while performing the following: • Referring to the illustration in Step DA90, grasp the harness closest to the sensor connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. • Is fault indicated?	Yes ▶ No ▶	ISOLATE fault and make necessary repairs. RERUN Quick Test. GO to **DA92**.
DA92 CHECK PROCESSOR AND HARNESS CONNECTORS		
• Key Off, wait 10 seconds. • Disconnect processor 60 pin connector. • Inspect both connectors and connector terminals for obvious damage or faults. • Are connectors and terminals OK?	No ▶ Yes ▶	SERVICE as necessary. RERUN Quick Test. Unable to duplicate fault at this time. Continuous code 58 testing complete.

Vane Air Temperature Sensor (VAT)

Pinpoint Test

DA

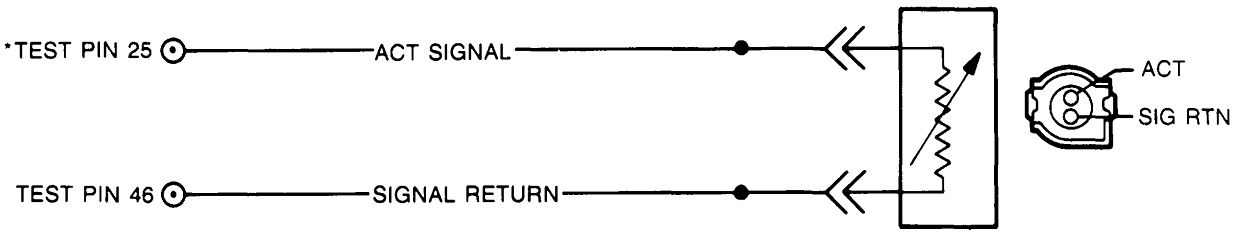
TEST STEP	RESULT ▶	ACTION TO TAKE
DA93 SERVICE CODE 68: CONTINUOUS TEST: CHECK VAT SENSOR o Using continuous monitor mode, observe VOM or STAR LED for indication of a fault while performing the following: o Lightly tap on VAT sensor (simulate road shock). o Wiggle VAT connector. o Is fault indicated?  POWER OR VREF CIRCUIT VAT SIG. SIG. RTN. PROCESSOR HARNESS VAT SENSOR **A9580-A**	Yes ▶	DISCONNECT and INSPECT connectors. If connector and terminals are good, REPLACE VAT sensor. RERUN Quick Test.
	No ▶	GO to **DA94**.
DA94 CHECK EEC-IV HARNESS o Observe VOM or STAR LED for a fault indication while performing the following: o Referring to the illustration in Step DA93, grasp the harness closest to the sensor connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. o Is fault indicated?	Yes ▶	ISOLATE fault and make necessary service. RERUN Quick Test.
	No ▶	GO to **DA95**.
DA95 CHECK PROCESSOR AND HARNESS CONNECTORS o Key Off, wait 10 seconds. o Disconnect processor 60 pin connector. o Inspect both connectors and connector terminals for obvious damage or faults. o Are connectors and terminals OK?	No ▶	SERVICE as necessary. RERUN Quick Test.
	Yes ▶	Unable to duplicate fault at this time. Continuous code 68 testing complete.

Air Charge Temperature Sensor (ACT)

Pinpoint Test

DB

DB



TYPICAL RESISTANCE BETWEEN TEST PINS 25 & 46	58.750 ohms	40.500 ohms	3600 ohms	1840 ohms
AT TEMPERATURE	50°F	65°F	180°F	220°F

***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

NOTE: Ambient temperature must be greater than 50°F for this test.

A9581-B

STOP-WARNING

You should enter this Pinpont Test only when a service code 24, 54 or 64 is received in Quick Test Step 3.0, 5.0 or 6.0.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Cooling system.
- Air cleaner duct problems.
- Improper engine oil level.

This pinpoint test is intended to diagnose only the following:

- ACT sensor.
- Harness circuits: ACT Signal and Signal Return.
- Processor assembly.

Air Charge Temperature Sensor (ACT) | Pinpoint Test | DB

TEST STEP	RESULT ▶	ACTION TO TAKE
DB1 SERVICE CODE 24: CHECK PROPER INSTALLATION		
• For vehicle with ACT mounted in intake manifold, GO to step DB2. • Is ACT mounted properly in air cleaner?	Yes ▶ No ▶	GO to DB2. INSTALL ACT properly. RERUN Quick Test.
DB2 CHECK FOR VREF AT THROTTLE POSITION SENSOR		
• Key Off, wait 10 seconds. • DVOM on 20V scale. • Disconnect TP sensor. • Key On, Engine Off. • Measure voltage at the TP vehicle harness connector between VREF and signal return.	Less than 4.0V or greater than 6.0V ▶ 4.0V to 6.0V ▶	GO to Pinpoint Test Step C1. RECONNECT TP sensor, GO to DB3.
DB3 CHECK ACT SENSOR — ENGINE OFF		
• Key Off, wait 10 seconds. • Harness disconnected from ACT sensor. • DVOM on 200,000 ohm scale. • Measure resistance of ACT sensor. **NOTE: Make sure engine is warmed up prior to this test.**	Reading is between 1,100 and 58,000 ohms (approximately 50°F) ▶ Reading is less than 1,100 ohms or greater than 58,000 ▶	GO to DB4. CHECK heat stove duct valve operation. If OK, REPLACE ACT sensor. RECONNECT harness to ACT sensor. RERUN Quick Test.
DB4 CHECK ACT SENSOR — ENGINE RUNNING		
• Key Off. Harness disconnected from ACT sensor. • DVOM on 200,000 ohm scale. • Run engine for 2 minutes. • Measure resistance of ACT sensor with engine running.	Reading is between 2,400 and 29,000 ohms ▶ Reading is less than 2,400 ohms or greater than 29,000 ohms ▶	REPLACE processor. RECONNECT harness to ACT sensor. RERUN Quick Test. CHECK heat stove duct valve operation. If OK, REPLACE ACT sensor. RERUN Quick Test.

Air Charge Temperature Sensor (ACT) | Pinpoint Test | DB

TEST STEP	RESULT ▶	ACTION TO TAKE
DB10 SERVICE CODE 54: INDUCE OPPOSITE CODE		
• Key Off, wait 10 seconds. • Disconnect vehicle harness from ACT sensor. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Insert a jumper wire at the ACT vehicle harness connector between ACT Signal and Signal Return. • Run Key On, Engine Off Quick Test. • Is code 64 present?	Yes ▶	REPLACE ACT sensor. REMOVE jumper wire. RECONNECT harness to ACT sensor. RERUN Quick Test.
	No ▶	REMOVE jumper wire. GO to **DB11**.
DB11 CONTINUITY CHECK ACT SIGNAL AND SIGNAL RETURN		
• Key Off, wait 10 seconds. • Harness disconnected from ACT sensor. • Disconnect processor 60 pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Install Breakout box. Leave processor disconnected. • DVOM on 200 ohm scale. • Measure resistance between ACT signal, at the ACT vehicle harness connector, and test Pin 25 at the Breakout box. • Measure resistance between Signal Return, at the ACT vehicle harness connector, and test Pin 46 at the Breakout box.	Both readings are less than 5 ohms ▶	REPLACE processor. REMOVE Breakout box. RECONNECT processor and ACT sensor. RERUN Quick Test.
	Either reading is 5 ohms or greater ▶	CORRECT circuit opens. REMOVE Breakout box. RECONNECT processor and ACT sensor. RERUN Quick Test.

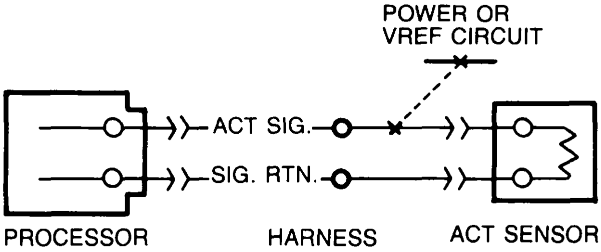
Air Charge Temperature Sensor (ACT) | Pinpoint Test | DB

TEST STEP	RESULT ▶	ACTION TO TAKE
DB20 SERVICE CODE 64: INDUCE OPPOSITE CODE		
○ Key Off, wait 10 seconds. ○ Disconnect vehicle harness from ACT sensor. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. ○ Run Key On, Engine Off Quick Test. ○ Is code 54 present?	Yes ▶	REPLACE ACT sensor. RECONNECT harness to ACT sensor. RERUN Quick Test.
	No ▶	GO to DB21.
DB21 CHECK FOR VREF AT THROTTLE POSITION SENSOR		
○ Key Off, wait 10 seconds. ○ DVOM on 20V scale. ○ Disconnect TP sensor. ○ Key On, Engine Off. ○ Measure voltage at the TP vehicle harness connector between VREF and Signal Return.	Less than 4.0V or greater than 6.0V ▶	GO to Pinpoint Test Step C1.
	4.0V to 6.0V ▶	RECONNECT TP sensor, GO to DB22.
DB22 CHECK ACT SIGNAL FOR SHORTS TO GROUND		
○ Key Off, wait 10 seconds. ○ Harness disconnected from ACT sensor. ○ Disconnect processor 60 pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. ○ DVOM on 200,000 ohm scale. ○ Measure resistance between test Pin 25 and test Pins 40, 46 and 60 at the Breakout box.	Any reading less than 10,000 ohms ▶	CORRECT circuit shorts. REMOVE Breakout box. RECONNECT processor and ACT sensor. RERUN Quick Test.
	All readings are 10,000 ohms or greater ▶	REPLACE processor. REMOVE Breakout box. RECONNECT processor and ACT sensor. RERUN Quick Test.

Air Charge Temperature (ACT)

Pinpoint Test

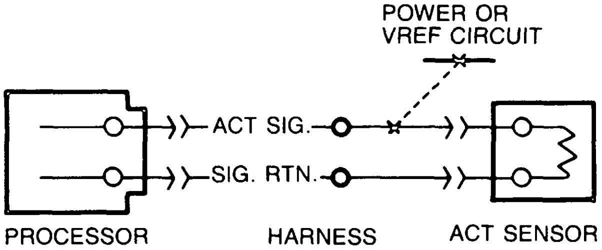
DB

TEST STEP	RESULT ▶	ACTION TO TAKE
DB90 SERVICE CODE 54: CONTINUOUS TEST: CHECK ACT SENSOR		
• Using continuous monitor mode, observe VOM or STAR LED for indication of a fault while performing the following: • Lightly tap on ACT sensor (simulate road shock). • Wiggle ACT connector. • Is a fault indicated?  POWER OR VREF CIRCUIT ACT SIG. SIG. RTN. PROCESSOR HARNESS ACT SENSOR A9582-A	Yes ▶	DISCONNECT and INSPECT connectors. If connector and terminals are good, REPLACE ACT sensor. RERUN Quick Test.
	No ▶	GO to **DB91**.
DB91 CHECK EEC-IV HARNESS		
• Observe VOM or STAR LED for a fault indication while performing the following: • Referring to the illustration in Step DB90, grasp the harness closest to the sensor connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. • Is fault indicated?	Yes ▶	ISOLATE fault and make necessary repairs. RERUN Quick Test.
	No ▶	GO to **DB92**.
DB92 CHECK PROCESSOR AND HARNESS CONNECTORS		
• Key Off, wait 10 seconds. • Disconnect processor 60 pin connector. • Inspect both connectors and connector terminals for obvious damage or faults. • Connectors and terminals are OK.	No ▶	SERVICE as necessary. RERUN Quick Test.
	Yes ▶	Unable to duplicate fault at this time. Continuous code 54 testing complete.

Air Charge Temperature (ACT)

Pinpoint Test

DB

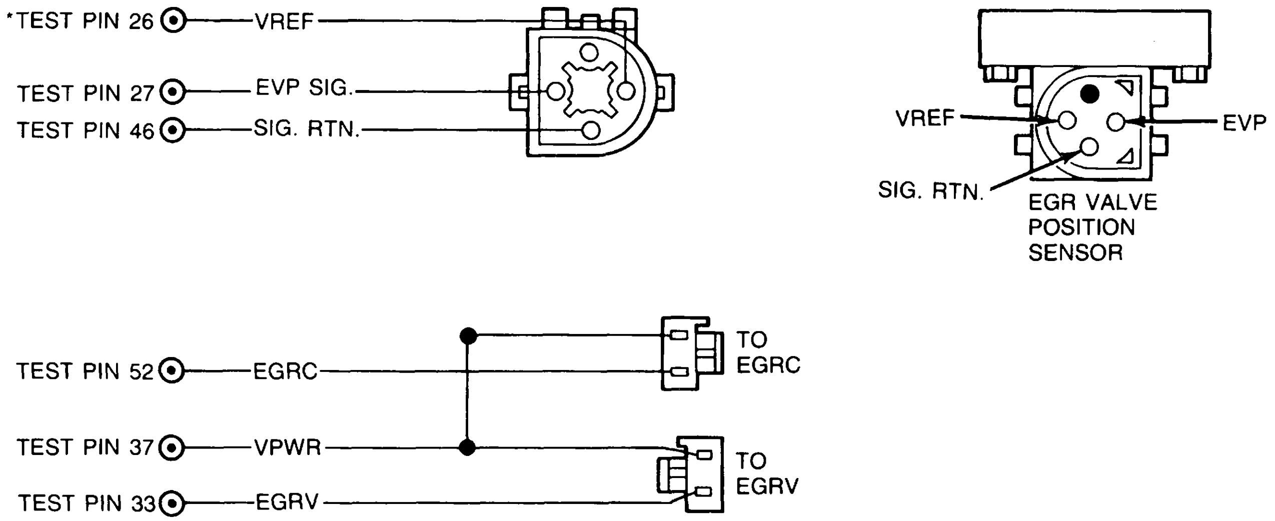
TEST STEP	RESULT	ACTION TO TAKE
DB93 SERVICE CODE 64: CONTINUOUS TEST: CHECK ACT SENSOR		
o Using continuous monitor mode, observe VOM or STAR LED for fault while performing the following: o Lightly tap on ACT sensor (simulate road shock). o Wiggle ACT connector. o Is fault indicated?  POWER OR VREF CIRCUIT ACT SIG. SIG. RTN. PROCESSOR HARNESS ACT SENSOR A9582-A	Yes ▶	DISCONNECT and INSPECT connectors. If connector and terminals are good, REPLACE ACT sensor. RERUN Quick Test.
	No ▶	GO to **DB94**.
DB94 CHECK EEC-IV HARNESS		
o Observe VOM or STAR LED for a fault indication while performing the following: o Referring to the illustration in Step DB93, grasp the harness closest to the sensor connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. o Is fault indicated?	Yes ▶	ISOLATE fault and make necessary repairs. RERUN Quick Test.
	No ▶	GO to **DB95**.
DB95 CHECK PROCESSOR AND HARNESS CONNECTORS		
o Key Off, wait 10 seconds. o Disconnect processor 60 pin connector. o Inspect both connectors and connector terminals for obvious damage or faults. o Connectors and terminals are OK.	No ▶	SERVICE as necessary. RERUN Quick Test.
	Yes ▶	Unable to duplicate fault at this time. Continuous code 64 testing complete.

EGR Valve Position Sensor (EVP) Control/Vent (EGRC/EGRV)

Pinpoint Test

DD

DD



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9583-A

STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 31, 32, 33, 34, 35, 83 or 84 is received in Quick Test Step 3.0, 5.0 or 6.0.

To prevent the replacement of good components, be aware that the following non-EEC area may be at fault:

- Damaged EGR valve.

This Pinpoint Test is intended to diagnose only the following:

- EVP sensor.
- Harness circuits: EVP, Signal Return, VREF, EGRV, EGRC, VPWR.
- EGR solenoids.
- EGR Valve assembly.
- Processor assembly.

EGR Valve Position Sensor (EVP) Control/Vent (EGRC/EGRV)

Pinpoint Test

DD

TEST STEP	RESULT ▶	ACTION TO TAKE
FAULT CODE 31		
DD1 RUN ENGINE RUNNING QUICK TEST WITH EGR VACUUM SIGNAL LINE DISCONNECTED AT EGR VALVE		
○ Key Off, wait 10 seconds. ○ Disconnect EGR vacuum line at EGR valve and cap EGR vacuum line. ○ Run Engine Running Quick Test. ○ Check for code 31.	Code 31 present ▶	GO to DD2.
	No code 31 present, but codes 32, 34 are present ▶	GO to DD11.
DD2 CHECK EVP RESISTANCE WHILE APPLYING VACUUM TO EGR VALVE		
○ Key Off, wait 10 seconds. ○ Vacuum signal line disconnected. ○ Disconnect vehicle harness at EVP sensor. ○ DVOM on 200,000 ohm scale. ○ Connect vacuum pump to EGR valve. ○ Measure resistance at the EVP sensor between EVP SIG and Vref while gradually increasing vacuum to 33 kPa (10 in.-Hg.). ○ Observe resistance as vacuum increases.	Reading gradually decreases from no greater than 5500 ohms to no less than 100 ohms ▶	GO to DD3.
	Reading is less than 100 ohms or greater than 5500 ohms ▶	REPLACE EVP sensor. RECONNECT signal line and harness. RERUN Quick Test.
	Reading does not decrease or unable to hold vacuum ▶	GO to DD16.
DD3 MEASURE VREF TO SIGNAL RETURN VOLTAGE		
○ Key On, Engine Off. ○ Vacuum signal line disconnected and capped, harness disconnected from EVP sensor. ○ DVOM on 20V scale. ○ Measure voltage at the EVP vehicle harness connector between VREF and Signal Return. ○ Is voltage reading between 4.0 and 6.0 volts?	Yes ▶	GO to DD4.
	No ▶	GO to Pinpoint Test Step C1.

EGR Valve Position Sensor (EVP) Control/Vent (EGRC/EGRV)

Pinpoint Test

DD

TEST STEP		RESULT ▶	ACTION TO TAKE
DD4	MEASURE CONTINUITY OF EVP SIGNAL CIRCUIT		
	• Key Off, wait 10 seconds. • Harness disconnected from EVP sensor. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box leaving processor disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 27 at the Breakout box and EVP signal at the EVP vehicle harness connector. • Is resistance less than 5 ohms?	Yes ▶ No ▶	GO to DD5. SERVICE open circuit. REMOVE Breakout box. RECONNECT processor and EVP sensor. RERUN Quick Test.
DD5	CHECK EVP SIGNAL FOR SHORTS TO VREF AND SIGNAL RETURN		
	• Key Off, harness disconnected from EVP sensor. Breakout box installed with processor not connected. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 27 and test Pins 26, 40, 46 and 60 at Breakout box. • Are all readings 10,000 ohms or greater?	Yes ▶ No ▶	GO to DD6. SERVICE short circuit. REMOVE Breakout box. RECONNECT processor and EVP sensor. RERUN Quick Test.
DD6	SUBSTITUTE EVP SENSOR AND EGR VALVE		
	• Key Off, wait 10 seconds. • Electrically connect known good EVP sensor and EGR valve assembly. • Remove Breakout box. • Reconnect processor. • Perform Key On, Engine Off Quick Test. • Is code 31 present?	Yes ▶ No ▶	REPLACE processor. CONNECT original EVP sensor and EGR valve assembly. RERUN Quick Test. GO to DD7.

EGR Valve Position Sensor (EVP) Control/Vent (EGRC/EGRV)

Pinpoint Test

DD

TEST STEP	RESULT ▶	ACTION TO TAKE
DD7 EVP SENSOR CHECK		
• Key Off, wait 10 seconds. • Install original EVP sensor on known good EGR valve. • EVP sensor connected. • Rerun Key On, Engine Off Quick Test. • Is code 31 present?	Yes ▶	INSTALL new EVP sensor. RERUN Quick Test.
	No ▶	REFER to EGR System, Section 6.
FAULT CODES 32, 33 AND 34		
DD11 OUTPUT STATE CHECK (REFER TO APPENDIX)		
NOTE: Do not use STAR tester for this test step. Use VOM/DVOM. • Key Off, wait 10 seconds. • DVOM on 20V scale. • Connect DVOM negative test lead to STO and positive test lead to battery positive. • Jumper STI to signal return. • Perform Key On, Engine Off Self-Test until the completion of the Continuous Test Codes. • DVOM will indicate zero volts. • Depress and release the throttle. • Did DVOM reading change to a high voltage reading?	No ▶	DEPRESS throttle to WOT and RELEASE. If STO voltage does not go high, GO to Pinpoint Test Step Q40.
	Yes ▶	Remain in output state check and GO to DD12.
DD12 CHECK EGR SOLENOIDS FOR ELECTRICAL CYCLING		
• Key On, Engine Off. • DVOM on 20V scale. • Reconnect DVOM to EGRV solenoid, between VPWR and EGRV signal. • While observing DVOM, depress and release the throttle several times to cycle output on and off. • Repeat for EGRC solenoid, between VPWR and EGRC signal. • Do both solenoid outputs cycle on and off?	Yes ▶	REMAIN in output state check. GO to DD13.
	No ▶	Exit output state check. GO to DD17.

EGR Valve Position Sensor (EVP) Control/Vent (EGRC/EGRV)

Pinpoint Test

DD

TEST STEP	RESULT ▶	ACTION TO TAKE
DD13 CHECK EGR SOLENOIDS FOR VACUUM CYCLING		
• Key On, Engine Off. • Still in output state check. • Disconnect and cap vacuum line from bottom port of EGRC solenoid and connect a vacuum pump. • Connect a vacuum gauge in the common output (top) vacuum line to EGR valve. • Disconnect but **do not** cap vacuum vent line from EGRV solenoid or remove filter from the top of the EGRV solenoid. • Apply vacuum. • While cycling outputs on and off (by depressing and releasing throttle), observe vacuum gauge at the output. Maintain vacuum at source. • Does the vacuum cycle on and off in less than 2 seconds?	Yes ▶ No ▶	RECONNECT all vacuum lines. GO to DD14. CHECK filter and common output vacuum line for obstructions. REPLACE as necessary. If OK, REPLACE solenoid assembly. RECONNECT all vacuum lines. RERUN Quick Test.
DD14 CHECK VACUUM LINES		
• Key Off, wait 10 seconds. • Vacuum lines reconnected. • Check entire EEC vacuum line system per VECI emission schematic decal for kinks, cracks, obstructions or leaks. • Are vacuum lines OK? **NOTE FOR 3.8L CFI (ONLY): Special attention should be given to the canister purge valve. A canister purge valve that is stuck open will apply vacuum to the EGR valve.**	Yes ▶ No ▶	GO to DD15. SERVICE as necessary. RERUN Quick Test.

EGR Valve Position Sensor (EVP) Control/Vent (EGRC/EGRV)

Pinpoint Test

DD

TEST STEP		RESULT ▶	ACTION TO TAKE
DD15	CHECK EVP RESISTANCE WHILE APPLYING VACUUM TO EGR VALVE		
	• Key Off. • Disconnect vehicle harness from EVP sensor. Inspect for damaged pins, corrosion, and pins pushed out. Service as necessary. • DVOM on 200,000 ohm scale. • Disconnect vacuum line at EGR valve. • Connect vacuum pump to EGR valve. • Measure resistance of the EVP sensor between EVP Signal Pin and VREF Pin while increasing vacuum to 33 kPa (10 in.-Hg.). • Observe resistance as vacuum increases. • Does the resistance gradually change between 5500 and 100 ohms?	Yes ▶	REPLACE processor. RECONNECT EVP sensor and EGR vacuum line. RERUN Quick Test.
		No ▶	GO to **DD16**.
DD16	MANUALLY EXERCISE EVP SENSOR		
	• Key Off, harness disconnected from EVP sensor. • Remove EVP sensor from EGR valve. • Measure resistance of the EVP sensor between EVP Signal Pin and VREF Pin while gradually applying pressure to EVP sensor shaft. • Observe resistance as shaft is slowly pushed in and slowly released. • Do either of the readings change suddenly between 5500 and 100 ohms? **NOTE: It is normal for the EVP sensor total resistance to drop below 100 ohms when disconnected from the EGR valve. A defective part will change resistance suddenly between 5500 and 100 ohms.**	Yes ▶	REPLACE EVP sensor. RECONNECT harness and EGR supply vacuum line. RERUN Quick Test.
		No ▶	REFER to EGR System, Section 6. RECONNECT EVP sensor and EGR supply vacuum line. RERUN Quick Test.
DD17	MEASURE EGRV/EGRC SOLENOID RESISTANCE		
	• Key Off, wait 10 seconds. • DVOM on 200 ohm scale. • Disconnect EGRV solenoid connector and measure solenoid resistance. Inspect for damaged pins, corrosion and pins pushed out. Service as necessary. • Disconnect EGRC solenoid connector and measure solenoid resistance. Inspect for damaged pins, corrosion and pins pushed out. Service as necessary. • Are both resistances between 30 and 70 ohms?	Yes ▶	CONNECT EGRC/ EGRV solenoids. GO to **DD18**.
		No ▶	REPLACE EGRC/ EGRV solenoid assembly. RERUN Quick Test.

EGR Valve Position Sensor (EVP) Control/Vent (EGRC/EGRV)

Pinpoint Test

DD

TEST STEP		RESULT ▶	ACTION TO TAKE
DD18	CHECK FOR VOLTAGE ON VEHICLE POWER CIRCUIT		
• Disconnect EGR vent and EGR control solenoids from harness. • Key On, Engine Off. • DVOM on 20V scale. • Measure voltage between battery negative terminal and VPWR circuit on both EGR solenoids. • Are both readings 10.5 volts or greater?		Yes ▶	GO to DD19.
		No ▶	SERVICE harness circuit open. RERUN Quick Test.
DD19	CHECK CONTINUITY OF EGRV AND EGRC CIRCUITS		
• Key Off, wait 10 seconds. • EGR vent and EGR control solenoid disconnected from harness. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box to processor harness connector. Leave processor disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 33 at the Breakout box and EGRV signal at the EGRV solenoid vehicle harness connector. • Measure resistance between test Pin 52 at the Breakout box and EGRC signal at the EGRC solenoid vehicle harness connector. • Are both readings less than 5 ohms?		Yes ▶	GO to DD20.
		No ▶	SERVICE open circuit. REMOVE Breakout box. RECONNECT harness to processor. RERUN Quick Test.
DD20	CHECK FOR SHORT TO GROUND		
• Key Off, wait 10 seconds. • DVOM on 200,000 ohm scale. • Leave Breakout box installed and processor disconnected. • EGRV/EGRC solenoids disconnected. • Measure resistance between test Pins 33 and/or 52 and test Pins 40, 46 and 60 at the Breakout box. • Is resistance less than 10,000 ohms?		Yes ▶	SERVICE short to ground. RERUN Quick Test.
		No ▶	GO to DD21.

EGR Valve Position Sensor (EVP) Control/Vent (EGRC/EGRV)

Pinpoint Test

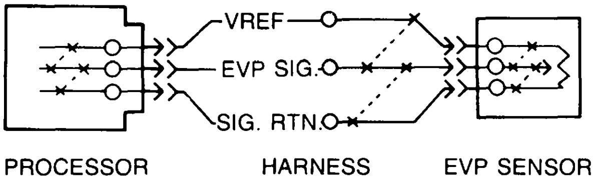
DD

TEST STEP	RESULT ►	ACTION TO TAKE
DD21 CHECK EGRV AND EGRC SIGNALS FOR SHORTS TO POWER		
• EGR vent and EGR control solenoids disconnected from harness. • Key Off, Breakout box installed. Processor disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 33 and test Pins 37 and 57 at the Breakout box. • Measure resistance between test Pin 52 and test Pins 37 and 57 at the Breakout box. • Are all readings 10,000 ohms or greater?	Yes ►	REPLACE processor. REMOVE Breakout box. RECONNECT harness to processor. RERUN Quick Test.
	No ►	SERVICE circuit short. REMOVE Breakout box. RECONNECT harness to processor. RERUN Quick Test. If code is repeated, REPLACE processor.
FAULT CODE 35		
DD30 RPM TOO LOW FOR EGR TEST		
• Is code 12 also present?	Yes ►	Vehicles equipped with air bypass (EFI), GO to **KE1**. Vehicles equipped with DC motor control, GO to **KF1**.
	No ►	GO to **DD31**.
DD31 RETEST AT 1,500 RPM		
• Key Off, wait 10 seconds. • Install tachometer. • Perform Key On, Engine Running Quick Test while maintaining 1,500 rpm. • Record Engine Running service codes. • Is code 35 still present?	Yes ►	REPLACE processor. RERUN Quick Test.
	No ►	RERUN Quick Test. SERVICE codes as necessary.

EGR Valve Position Sensor (EVP) Control/Vent (EGRC/EGRV)

Pinpoint Test

DD

TEST STEP	RESULT ▶	ACTION TO TAKE
DD90 SERVICE CODE 31 CONTINUOUS TEST: EXERCISE EVP SENSOR		
• Using continuous monitor mode, observe VOM or STAR LED for indication of a fault while performing the following: • Connect a vacuum pump to the EGR valve. • Very slowly apply 20 kPa (6 in.-Hg.) vacuum to the EGR valve. • Slowly bleed vacuum off the EGR valve and lightly tap on EVP sensor (simulate road shock). • Wiggle EVP sensor connector. • Is a fault indicated?  VREF EVP SIG. SIG. RTN. PROCESSOR HARNESS EVP SENSOR A9584-A	Yes ▶ No ▶	GO to DD91. GO to DD92.
DD91 MEASURE EVP SIGNAL VOLTAGE WHILE EXERCISING EVP SENSOR		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box and reconnect processor. • VOM or STAR LED still connected to STO as in previous Step. • Connect a DVOM from test Pin 27 to test Pin 46. • DVOM on 20V scale. • Key On, Engine Off. • While observing DVOM, repeat Step DD90. • Does the fault occur below 4.25V?	Yes ▶ No ▶	DISCONNECT and INSPECT connector. If connector and terminals are good, REPLACE EVP sensor. RERUN Quick Test. EGR valve overshoot may have caused continuous code 31. Sensor service is not required. To verify harness integrity, GO to DD92.

EGR Valve Position Sensor (EVP) Control/Vent (EGRC/EGRV)

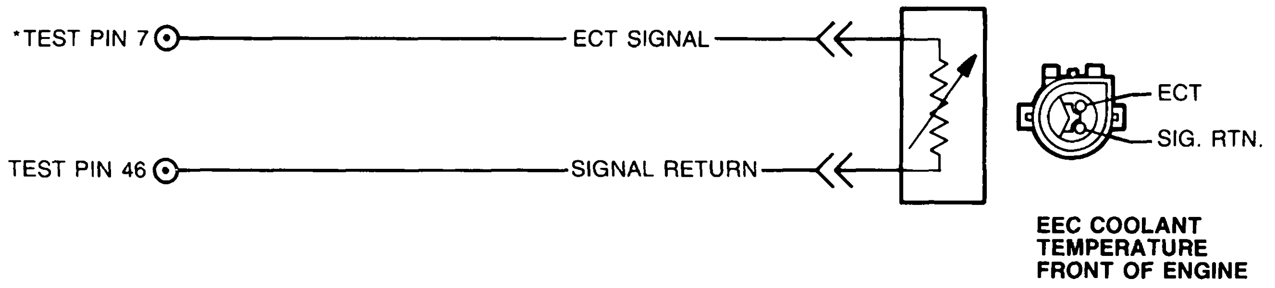
Pinpoint Test

DD

TEST STEP	RESULT ▶	ACTION TO TAKE
DD92 CHECK EEC-IV HARNESS		
o Observe VOM or STAR LED for a fault indication while performing the following: o Referring to the illustration in Step DD90, grasp the harness closest to the sensor connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. o Is a fault indicated?	Yes ▶	ISOLATE fault and SERVICE as necessary. REFER to appropriate figure. RERUN Quick Test.
	No ▶	GO to DD93.
DD93 CHECK PROCESSOR AND HARNESS CONNECTORS		
o Key Off, wait 10 seconds. o Disconnect processor 60 Pin connector. o Inspect both connectors and connector terminals for obvious damage or faults. o Are connectors and terminals OK?	No ▶	SERVICE as necessary. RERUN Quick Test.
	Yes ▶	Unable to duplicate fault at this time. Continuous code 31 testing complete.

Engine Coolant Temperature Sensor (ECT) | Pinpoint Test | DE

DE



NOTE: TO PASS THIS TEST, ENGINE COOLANT TEMPERATURE MUST BE:
KEY ON, ENGINE OFF (50°F TO 240°F)
ENGINE RUNNING (180°F TO 240°F)

TYPICAL RESISTANCE BETWEEN TEST PINS 7 & 46	58,750 ohms	40,500 ohms	3600 ohms	1840 ohms
AT TEMPERATURE	50°F	65°F	180°F	220°F

***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9585-A

STOP-WARNING

You should enter this Pinpont Test only when a service code 21, 51 or 61 is received in Quick Test Step 3.0, 5.0 or 6.0.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Coolant level.
- Oil level.
- Blocked or obstructed air flow.
- Engine not at normal operating temperature.
- Electro drive cooling fan.
- Open thermostat.

This pinpoint test is intended to diagnose only the following:

- ECT sensor.
- Harness sensor circuits: ECT and Signal Return.
- Processor assembly.

Engine Coolant Temperature Sensor (ECT) | Pinpoint Test | DE

TEST STEP	RESULT ▶	ACTION TO TAKE
DE1 SERVICE CODE 21: CHECK ENGINE OPERATING TEMPERATURE		
• Run engine for 2 minutes at 2,000 rpm. • Check that upper radiator hose is hot and pressurized. • Rerun Quick Test. • Is code 21 present?	Vehicle stalls ▶	Do not service code 21 at this time. REFER to diagnosis by symptoms.
	Yes ▶	GO to DE2.
	No ▶	SERVICE other codes as necessary.
DE2 CHECK FOR VREF AT THROTTLE POSITION SENSOR		
• Refer to illustration Q. • Key Off, wait 10 seconds. • DVOM on 20V scale. • Disconnect TP sensor. • Key On, Engine Off. • Measure voltage at the TP vehicle harness connector between VREF and signal return. • Is voltage reading between 4.0 and 6.0 volts?	Yes ▶	RECONNECT TP sensor, GO to DE3.
	No ▶	GO to Pinpoint Test Step C1.
DE3 ECT SENSOR CHECK		
NOTE: Engine may have cooled down. Always warm engine before taking ECT resistance measurement. Check for open thermostat. • Key Off, wait 10 seconds. • Harness disconnected from ECT sensor. • DVOM on 200,000 ohm scale. • Measure resistance of the ECT sensor. • Is the resistance reading: — 1300 ohms (240°F) to 7700 ohms (140°F) for engine off? — 1550 ohms (230°F) to 4550 ohms (180°F) for engine running?	Yes ▶	REPLACE processor. RECONNECT harness to ECT sensor. RERUN Quick Test.
	No ▶	REPLACE ECT sensor. RECONNECT harness to ECT sensor. RERUN Quick Test.

Engine Coolant Temperature Sensor (ECT) | Pinpoint Test | DE

TEST STEP	RESULT ▶	ACTION TO TAKE
DE10 SERVICE CODE 51: INDUCE OPPOSITE CODE		
• Key Off, wait 10 seconds. • Disconnect vehicle harness from ECT sensor. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Insert a jumper wire at the ECT sensor vehicle harness connector between ECT Signal and Signal Return. • Run Key On, Engine Off Quick Test. • Is code 61 present?	Yes ▶	REPLACE ECT sensor. REMOVE jumper wire. RECONNECT ECT sensor. RERUN Quick Test.
	No ▶	GO to DE11.
DE11 CHECK CONTINUITY OF ECT SIGNAL AND SIGNAL RETURN		
• Key Off, wait 10 seconds. • Harness disconnected from ECT sensor, jumper wire removed. • Disconnect processor 60 pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Install Breakout box to harness leaving processor disconnected. • DVOM on 200 ohm scale. • Measure resistance between ECT signal at the ECT vehicle harness connector and test Pin 7 at the Breakout box. • Measure resistance between Signal Return at the ECT sensor vehicle harness connector, and test Pin 46 at the Breakout box. • Are both readings less than 5 ohms?	Yes ▶	REPLACE processor. REMOVE Breakout box. RECONNECT processor and ECT sensor. RERUN Quick Test.
	No ▶	SERVICE open circuit(s). REMOVE Breakout box. RECONNECT processor and ECT sensor. RERUN Quick Test.

Engine Coolant Temperature Sensor (ECT)

Pinpoint Test

DE

TEST STEP	RESULT ►	ACTION TO TAKE
DE20 SERVICE CODE 61: INDUCE OPPOSITE CODE		
○ Key Off, wait 10 seconds. ○ Disconnect vehicle harness from ECT sensor. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. ○ Run Key On, Engine Off Quick Test.	Yes ►	REPLACE ECT sensor. RECONNECT ECT sensor. RERUN Quick Test.
○ Is code 51 present?	No ►	GO to DE21.
DE21 CHECK FOR VREF AT THROTTLE POSITION SENSOR		
○ Refer to Illustration Q. ○ Key Off, wait 10 seconds. ○ DVOM on 20V scale. ○ Disconnect TP sensor.	Yes ►	RECONNECT TP sensor, GO to DE22.
○ Key On, Engine Off. ○ Measure voltage at the TP vehicle harness connector between VREF and signal return. ○ Is voltage reading between 4.0 and 6.0 volts?	No ►	GO to Pinpoint Test Step C1.
DE22 CHECK ECT SIGNAL FOR SHORT		
○ Key Off, wait 10 seconds. ○ Harness disconnected from ECT sensor. ○ Disconnect processor 60 pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. ○ Install Breakout box, leave processor disconnected.	Yes ►	REPLACE processor. REMOVE Breakout box. RECONNECT processor and ECT harness. RERUN Quick Test.
○ DVOM on 200,000 ohm scale. ○ Measure resistance between test Pin 7 and test Pins 40, 46 and 60 at the Breakout box. ○ Are resistance readings 10,000 ohms or greater?	No ►	SERVICE circuit shorts. REMOVE Breakout box. RECONNECT processor and ECT sensor. RERUN Quick Test.

Engine Coolant Temperature Sensor (ECT)

Pinpoint Test

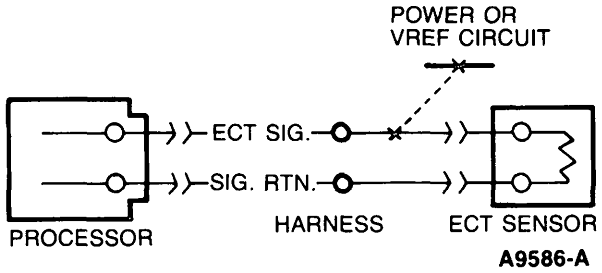
DE

TEST STEP		RESULT ▶	ACTION TO TAKE
DE90	SERVICE CODE 21: CONTINUOUS TEST: TEST DRIVE VEHICLE		
	• Key Off and wait 10 seconds. • Disconnect all Self-Test equipment and prepare vehicle for test drive. • Drive vehicle. Try to simulate different drive modes or mode in which drive complaint is noticed. Attempt to maintain drive complaint mode for one minute or more, if possible. • Upon completion of drive evaluation, repeat Key On, Engine Off Self-Test. • Is code 21 present in the continuous test results?	Yes ▶	VERIFY thermostat operating properly. If OK, REPLACE ECT sensor. RERUN Quick Test.
		No ▶	Unable to duplicate fault. Code 21 testing complete.

Engine Coolant Temperature (ECT)

Pinpoint Test

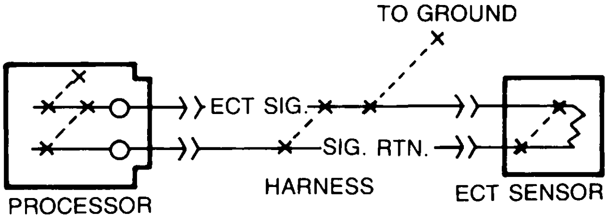
DE

TEST STEP	RESULT ▶	ACTION TO TAKE
DE91 SERVICE CODE 51: CONTINUOUS TEST: CHECK ECT SENSOR		
○ Using continuous monitor mode, observe VOM or STAR LED for indication of a fault while performing the following: ○ Lightly tap on ECT sensor (simulate road shock). ○ Wiggle ECT connector. ○ Is a fault indicated?	Yes ▶	DISCONNECT and INSPECT connectors. If connector and terminals are good, REPLACE ECT sensor. RERUN Quick Test.
 POWER OR VREF CIRCUIT ECT SIG. SIG. RTN. PROCESSOR HARNESS ECT SENSOR A9586-A	No ▶	GO to DE92.
DE92 CHECK EEC-IV HARNESS		
○ Observe VOM or STAR LED for a fault indication while performing the following: ○ Referring to the illustration in Step DE91, grasp the harness closest to the sensor connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. ○ Is fault indicated?	Yes ▶ No ▶	ISOLATE fault and make necessary repairs. RERUN Quick Test. GO to DE93.
DE93 CHECK PROCESSOR AND HARNESS CONNECTORS		
○ Key Off, wait 10 seconds. ○ Disconnect processor 60 pin connector. ○ Inspect both connectors and connector terminals for obvious damage or faults. ○ Connectors and terminals are OK.	No ▶ Yes ▶	SERVICE as necessary. RERUN Quick Test. Unable to duplicate fault at this time. Continuous code 51 testing complete.

Engine Coolant Temperature (ECT)

Pinpoint Test

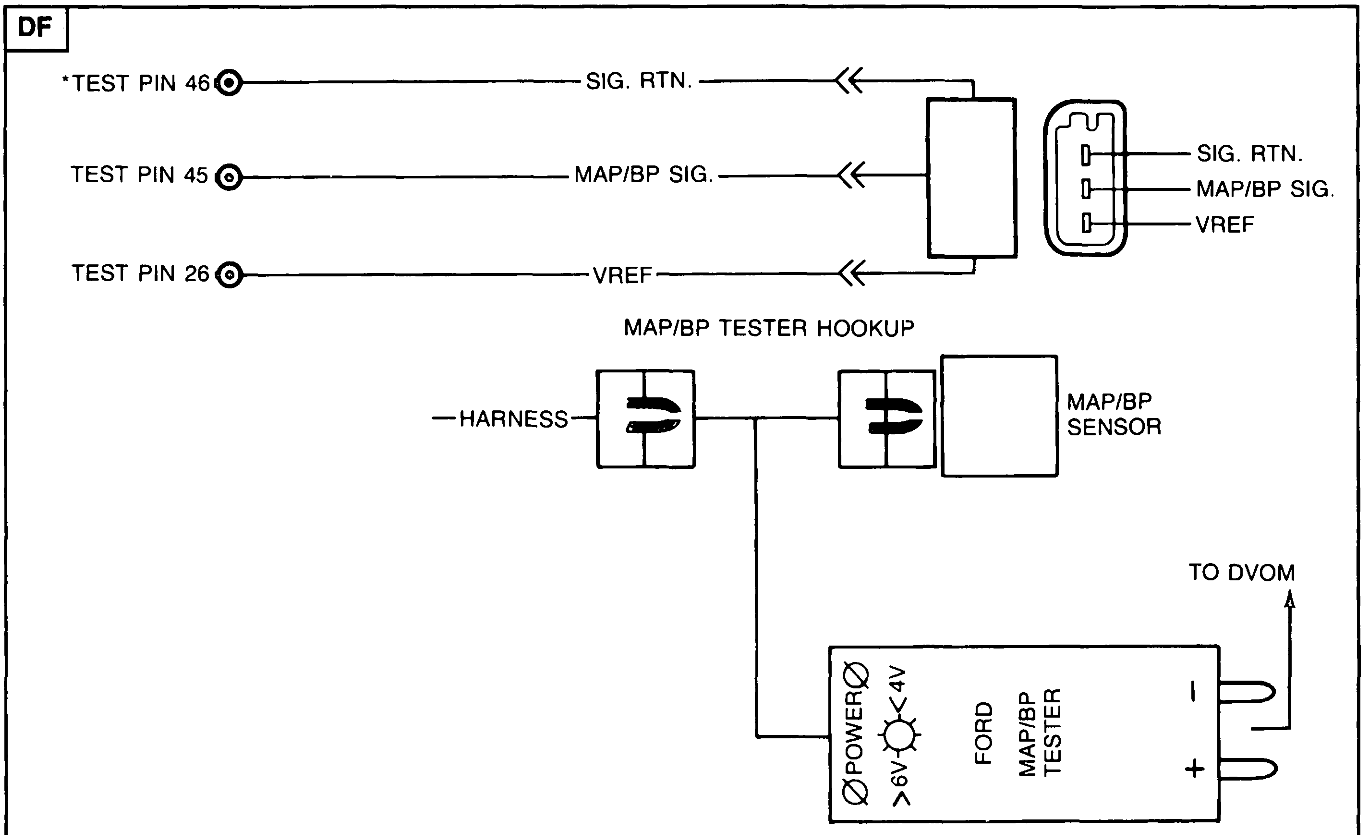
DE

TEST STEP	RESULT ▶	ACTION TO TAKE
DE94 SERVICE CODE 61: CONTINUOUS TEST: CHECK ECT SENSOR		
• Using continuous monitor mode, observe VOM or STAR LED for indication of a fault while performing the following: • Lightly tap on ECT sensor (simulate road shock). • Wiggle ECT connector. Voltage greater than 5 volts or STAR LED Off. • Is fault indicated?  TO GROUND ECT SIG. SIG. RTN. PROCESSOR HARNESS ECT SENSOR A9587-A	Yes ▶	DISCONNECT and INSPECT connectors. If connector and terminals are good, REPLACE ECT sensor. RERUN Quick Test.
	No ▶	GO to DE95.
DE95 CHECK EEC-IV HARNESS		
• Observe VOM or STAR LED for a fault indication while performing the following: • Referring to the illustration in Step DE94, grasp the harness closest to the sensor connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. • Is fault indicated?	Yes ▶	ISOLATE fault and make necessary repairs. RERUN Quick Test.
	No ▶	GO to DE96.
DE96 CHECK PROCESSOR AND HARNESS CONNECTORS		
• Key Off, wait 10 seconds. • Disconnect processor 60 pin connector. • Inspect both connectors and connector terminals for obvious damage or faults. • Connectors and terminals are OK.	No ▶	SERVICE as necessary. RERUN Quick Test.
	Yes ▶	Unable to duplicate fault at this time. Continuous code 61 testing complete.

Manifold Absolute Pressure (MAP)/ Barometric Pressure (BP) Sensor

Pinpoint Test

DF



*TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9588-A

STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 22 or 72 is received in Quick Test Step 3.0, 5.0 or 6.0 or when directed here from Pinpoint Test S or Diagnostics by Symptom in the Engine Supplement Section.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Unusually high/low atmospheric barometer reading (MAP/BP).
- Kinked or obstructed vacuum lines (MAP).
- Basic engine (valves, vacuum leaks, timing, EGR valve (MAP), etc.).
- Key On, Engine Off — MAP sensor must **not** see vacuum.
- Engine Running — MAP sensor must see actual manifold vacuum.

This Pinpoint Test is intended to diagnose only the following:

- MAP/BP sensor.
- Harness circuits: VREF, MAP/BP Signal, and Signal Return.
- Processor assembly.
- MAP vacuum line.

Manifold Absolute Pressure (MAP)/ Barometric Pressure (BP) Sensor

Pinpoint Test

DF

TEST STEP	RESULT ▶	ACTION TO TAKE
FAULT CODE 22, ENGINE OFF		
DF1 CONNECTING MAP/BP TESTER		
• Key Off. • Disconnect the MAP/BP sensor from the vehicle harness. • Connect the MAP/BP tester between the vehicle harness and the MAP/BP sensor. • Insert tester banana plugs into DVOM. • Set DVOM to 20V scale. • Refer to illustration DF.	Tester properly hooked up ▶	GO to **DF2**.
DF2 POWER TO MAP/BP SENSOR TEST		
• MAP/BP tester connected. • Key On. • Observe red and green lights.	(ONLY) Green light, Vref is OK ▶	GO to **DF4**.
	"Less than 4V" light (RED) or no lights, Vref is too low OR "Greater than 6V" light (Red), Vref is too high ▶	GO to **DF3**.
DF3 VREF ISOLATION		
• MAP/BP tester connected. • Key On. • Disconnect MAP/BP • Observe red and green lights.	(ONLY) Green light, Vref is OK ▶	REPLACE MAP/BP sensor. RERUN Quick Test.
	"Less than 4V" light (RED) or no lights, Vref is too low OR "Greater than 6V" light (Red), Vref is too high ▶	REMOVE MAP/BP tester. GO to Pinpoint Test Step **C1**.

Manifold Absolute Pressure (MAP)/ Barometric Pressure (BP) Sensor

Pinpoint Test

DF

TEST STEP	RESULT ▶	ACTION TO TAKE
DF4 MAP/BP TESTER OUTPUT READING		
• MAP tester connected, refer to Note. • Key On. • Approximate Altitude (Ft.) — Voltage Output (+/−.04 Volts) 0 — 1.59 1000 — 1.56 2000 — 1.53 3000 — 1.50 4000 — 1.47 5000 — 1.44 6000 — 1.41 7000 — 1.39 **NOTE: Measure several known good MAP sensors on available vehicles. The measured voltage will be typical for your location on the day of testing.** • Is reading in range for your altitude?	Yes ▶	REMOVE MAP/BP Tester. GO to **DF5**.
	No (Sensor output is out-of-range) ▶	REMOVE MAP/BP Tester. GO to **DF6**.
DF5 CHECK CONTINUITY OF MAP/BP SIGNAL		
• Key Off, wait 10 seconds. • Harness disconnected from MAP/BP sensor. • Disconnect processor 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Install Breakout box. Leave processor disconnected. • DVOM on 200 ohm scale. • Measure resistance between MAP/BP signal at the MAP/BP sensor vehicle harness connector and test Pin 45 at the Breakout box. • Is resistance reading 5.0 ohms or less?	Yes ▶	REPLACE processor. CONNECT harness and MAP/BP sensor. RERUN Quick Test.
	No ▶	SERVICE circuit opens. REMOVE Breakout box. RECONNECT processor and MAP/BP sensor. RERUN Quick Test.
DF6 CHECK MAP/BP SIGNAL FOR SHORTS TO VREF; SIGNAL RETURN AND GROUND		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box, leave processor disconnected. • Harness disconnected from MAP/BP sensor. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 45 and test Pins 26, 46, 40 and 60 at the Breakout box. • Are all resistance readings 10,000 ohms or greater?	Yes ▶	REPLACE MAP/BP sensor. REMOVE Breakout box. RECONNECT electrical connections. RERUN Quick Test.
	No ▶	SERVICE circuit shorts. REMOVE Breakout box. RECONNECT processor and MAP/BP Sensor. RERUN Quick Test.

Manifold Absolute Pressure (MAP)/ Barometric Pressure (BP) Sensor

Pinpoint Test

DF

TEST STEP	RESULT ▶	ACTION TO TAKE
CODE 22 ENGINE RUNNING		
DF7 CHECK FOR EGR CODES		
• Are service codes 31, 32, 33, 34 or 35 present?	Yes ▶	GO to Quick Test Step 5.0 for appropriate Pinpoint Test.
	No ▶	GO to **DF8**.
DF8 CHECK MAP SENSOR		
• Key Off, wait 10 seconds. • Disconnect vacuum line from MAP sensor. • Install vacuum pump to MAP sensor. • Apply 18 in.-Hg. vacuum to MAP sensor. • Does MAP sensor hold vacuum?	Yes ▶	RELEASE vacuum. GO to **DF9**.
	No ▶	REPLACE MAP sensor. CONNECT vacuum line to MAP sensor. RERUN Quick Test.
DF9 ATTEMPT TO ELIMINATE CODE 22 (ENGINE RUNNING)		
• Key Off, wait 10 seconds. • Plug MAP vacuum supply hose. • Start engine and maintain 1500 ± 100 engine rpm. • Slowly apply 15 in.-Hg. vacuum to MAP sensor. • While maintaining rpm, perform Engine Running Quick Test. • Is code 22 still present? **NOTE: Disregard any other codes at this time.**	Yes ▶	REPLACE MAP sensor. CONNECT vacuum line to MAP sensor. RERUN Quick Test.
	No ▶	INSPECT vacuum supply hose to MAP sensor. SERVICE as necessary. If OK, SERVICE other engine running codes. If none, GO to Diagnostic Routines, Section 2 for a low vacuum problem.

Manifold Absolute Pressure (MAP)/ Barometric Pressure (BP) Sensor

Pinpoint Test

DF

TEST STEP	RESULT ▶	ACTION TO TAKE
FAULT CODE 72		
DF10 CHECK THAT VACUUM TO MAP SENSOR DECREASES DURING DYNAMIC RESPONSE		
o Key Off, wait 10 seconds. o Tee a vacuum gauge in the intake manifold vacuum line at the MAP sensor. o Perform Engine Running Quick Test while observing vacuum. o Record engine service codes. o Did vacuum decrease by more than 30 kPa (10 in.-Hg.) during dynamic response test? o Is code 72 present?	Vacuum decrease is 30 kPa (10 in.-Hg.) or greater and code 72 is not present ▶	DISCONNECT vacuum equipment and SERVICE other codes as necessary.
	Vacuum decrease is 30 kPa (10 in.-Hg.) or greater and code 72 is present ▶	REPLACE MAP sensor and RERUN Quick Test.
	Vacuum decrease is less than 30 kPa (10 in.-Hg.) ▶	GO to DF11.
DF11 CHECK VACUUM LINES		
o Check vacuum line for proper routing. Refer to VECI decal. Check MAP sensor vacuum line for kinks or blockage. o Vacuum lines are OK.	Yes ▶	EEC-IV system OK. REFER to Shop Manual, Group 21 for probable subjects affecting engine vacuum.
	No ▶	SERVICE as necessary and REPEAT DF10.
DF20 CONNECTING MAP/BP TESTER		
o Key Off. o Disconnect the MAP/BP sensor from the vehicle harness. o Connect the MAP/BP Tester between the vehicle harness and the MAP/BP sensor. o Plug tester banana plugs into DVOM. o Set DVOM to 20V scale. o Refer to illustration DF.	Tester properly hooked up ▶	GO to DF21.

Manifold Absolute Pressure (MAP)/ Barometric Pressure (BP) Sensor

Pinpoint Test

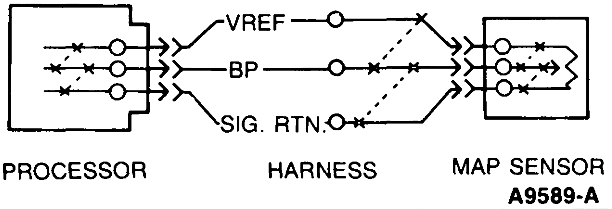
DF

<table>
<tr><th>TEST STEP</th><th>RESULT ▶</th><th>ACTION TO TAKE</th></tr>
<tr><td rowspan="2">DF21 MAP/BP TESTER OUTPUT READING
• MAP Tester connected, refer to Note.
• Key On.
•
<table>
<tr><th>Approximate Altitude (Ft.)</th><th>Voltage Output (+/−.04 Volts)</th></tr>
<tr><td>0</td><td>1.59</td></tr>
<tr><td>1000</td><td>1.56</td></tr>
<tr><td>2000</td><td>1.53</td></tr>
<tr><td>3000</td><td>1.50</td></tr>
<tr><td>4000</td><td>1.47</td></tr>
<tr><td>5000</td><td>1.44</td></tr>
<tr><td>6000</td><td>1.41</td></tr>
<tr><td>7000</td><td>1.39</td></tr>
</table>
NOTE: Measure several known good MAP sensors on available vehicles. The measured voltage will be typical for your location on the day of testing.
• Is reading in range for your altitude?</td><td>Yes ▶</td><td>For 1.9L EFI and 2.3L EFI TC engines GO to Diagnostic by Symptom in the Engine Supplement Section. For all others, GO to DF22.</td></tr>
<tr><td>No (Sensor output is out-of-range) ▶</td><td>REPLACE MAP/BP sensor.</td></tr>
<tr><td rowspan="2">DF22 VACUUM LINE CHECK
• Check MAP sensor vacuum line for holes, disconnections, kinks or blockage.
• Are vacuum lines OK?</td><td>Yes ▶</td><td>GO to Diagnostics by Symptom in the Engine Supplement Section.</td></tr>
<tr><td>No ▶</td><td>SERVICE vacuum lines to MAP sensor. RERUN Quick Test.</td></tr>
</table>

Manifold Absolute Pressure (MAP)/ Barometric Pressure (BP) Sensor

Pinpoint Test

DF

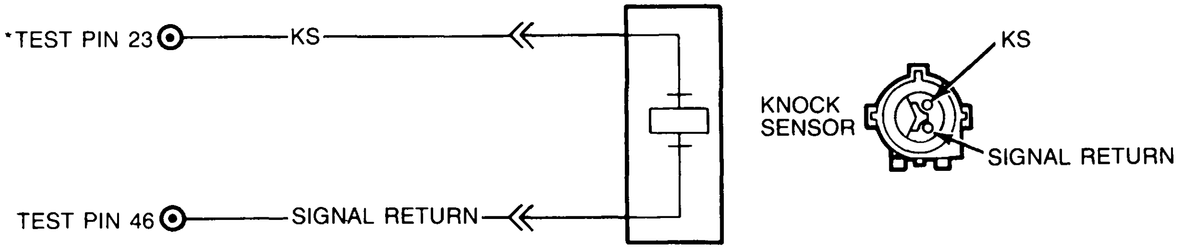
TEST STEP	RESULT ▶	ACTION TO TAKE
DF90 SERVICE CODE 22: CONTINUOUS TEST: EXERCISE MAP SENSOR		
• Using continuous monitor mode, observe VOM or STAR LED for indication of a fault while performing the following: • Connect a vacuum pump to the MAP sensor. • Slowly apply 84 kPa (25 in.-Hg.) vacuum to the sensor. • Slowly bleed vacuum off the MAP sensor. • Lightly tap on MAP sensor (simulate road shock). • Wiggle MAP connector. • Is fault indicated?  VREF BP SIG. RTN. PROCESSOR HARNESS MAP SENSOR A9589-A	Yes ▶	DISCONNECT and INSPECT connectors. If connector and terminals are good, REPLACE sensor. RERUN Quick Test.
	No ▶	GO to DF91.
DF91 CHECK EEC-IV HARNESS		
• Observe VOM or STAR LED for a fault indication while performing the following: • Referring to the illustration in Step DF90, grasp the harness closest to the sensor connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. • Is a fault indicated?	Yes ▶	ISOLATE fault and SERVICE as necessary. RERUN Quick Test.
	No ▶	GO to DF92.
DF92 CHECK PROCESSOR AND HARNESS CONNECTORS		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector. • Inspect both connectors and connector terminals for obvious damage or faults. • Are connectors and terminals OK?	No ▶	SERVICE as necessary. RERUN Quick Test.
	Yes ▶	Unable to duplicate fault at this time. Continuous code 22 testing complete.

Knock Sensor

Pinpoint Test

DG

DG



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9590-A

STOP-WARNING

You should enter this Pinpoint Test only when a service code 25 is received in Quick Test Step 5.0 or you are directed here from Diagnostics by Symptom in the Engine Supplement Section.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Fuel (quality).
- Basic engine.
- Spark timing.

This Pinpoint Test is intended to diagnose only the following:

- Knock sensor.
- Harness circuits: KS and Signal Return.
- Processor assembly.

Knock Sensor | Pinpoint Test | DG

TEST STEP	RESULT ▶	ACTION TO TAKE
DG1 SERVICE CODE 25: GENERATE KNOCK MANUALLY		
NOTE: With knock conditions sensitive to fuel, altitude and weather, perform Step DG1 before servicing any components. o Prepare vehicle to run (Engine Running Self-Test). o Equipment needed: 4 oz. hammer. o Prepare to rap/tap on exhaust manifold, directly above the knock sensor, when the Dynamic Response Signal is given. **NOTE: There is no need to actually depress throttle at this point.** o Perform Engine Running Self-Test. o Rap moderately on exhaust manifold when meter indicates Dynamic Response Test is ready. o 15 seconds later a code will be generated. o Check for code 25. **NOTE: Ignore all other codes at this point.**	No ▶	Knock system OK. REPEAT Engine Running Self-Test and SERVICE any other codes from that test.
	Yes ▶ **NOTE: Service code 25 may be received whenever the engine is not tapped**	GO to **DG2**.
DG2 TEST KNOCK CIRCUIT FOR VOLTAGE		
o Key Off, wait 10 seconds. o Disconnect knock sensor connector and inspect. o Set DVOM on 20V scale. o Key On, Engine Off. o Measure voltage at the vehicle harness connector between KS and signal return.	Voltage is between 1 and 4V ▶	GO to **DG6**.
	Voltage is less than 1V ▶	GO to **DG3**.
	Voltage is greater than 4V ▶	GO to **DG5**.
DG3 CHECK CONTINUITY OF KS AND SIGNAL RETURN CIRCUITS		
o Key Off, wait 10 seconds. o Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. o Connect Breakout box to harness. Leave processor disconnected. o Knock sensor disconnected. o DVOM on 200 ohm scale. o Measure resistance between Signal Return at the vehicle harness and test Pin 46 at the Breakout box and between KS at the vehicle harness and test Pin 23 at the Breakout box.	Both resistances less than 5 ohms ▶	GO to **DG4**.
	Either resistance 5 ohms or greater ▶	SERVICE open circuit. RERUN Quick Test.

Knock Sensor

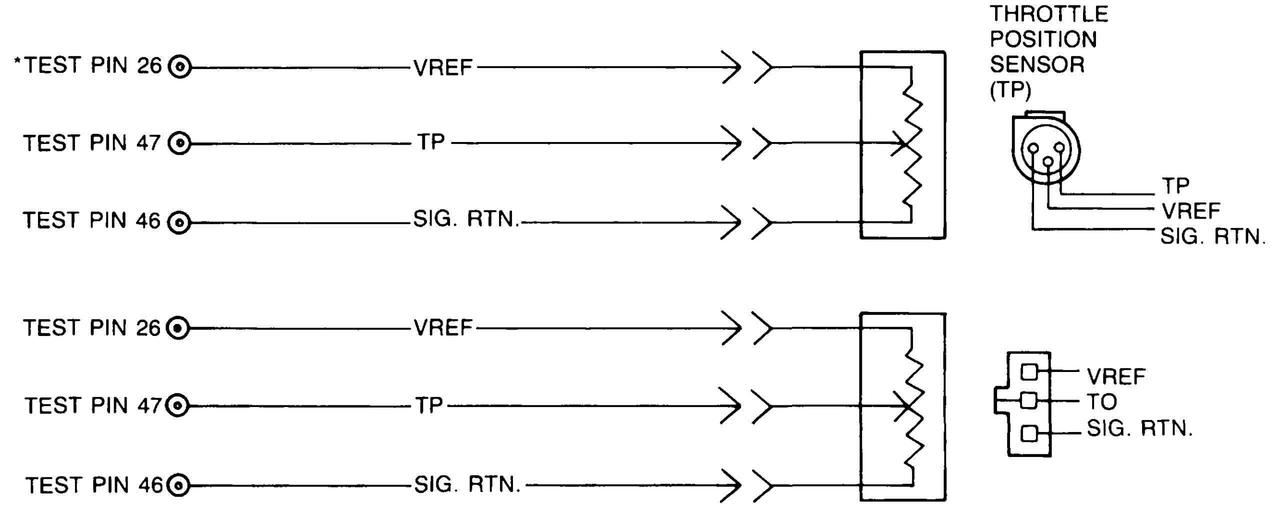
Pinpoint Test

DG

TEST STEP	RESULT ▶	ACTION TO TAKE
DG4 CHECK KS CIRCUIT FOR SHORT TO GROUND		
• Key Off, wait 10 seconds. • Breakout box installed. • Processor disconnected. • Knock sensor disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between KS at the vehicle harness and test Pins 40, 46 and 60 at the Breakout box.	All resistances 10,000 ohms or greater ▶ Any resistance less than 10,000 ohms ▶	GO to DG6. SERVICE harness short. RERUN Quick Test.
DG5 CHECK KS CIRCUIT FOR SHORT TO VOLTAGE		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Connect Breakout box to harness. Leave processor disconnected. • Knock sensor disconnected. • Key On, Engine Off. • DVOM on 20V scale. • Measure voltage between test Pin 23 and test Pin 40 at the Breakout box.	0.5V or greater ▶ Less than 0.5V ▶	SERVICE harness short to power. RERUN Quick Test. GO to DG6.
DG6 TEST PROCESSOR WITH SUBSTITUTE KNOCK SENSOR		
• Key Off, wait 10 seconds. • Remove Breakout box and reconnect processor. • Equipment Required: — Equivalent knock sensor (same part number). — 4 oz. hammer. • Plug substitute sensor in harness (do not install). • Perform Engine Running Self-Test. • Lightly tap knock sensor when Dynamic Test Ready Signal is given. • 15 seconds later, a code will be generated. • Check for code 25. **NOTE: Ignore all other codes at this time.**	No ▶ Yes ▶	INSTALL new knock sensor. RERUN Quick Test. REPLACE processor and REMOVE substitute sensor. RERUN Quick Test with original sensor.

Throttle Position Sensor (TPS) | Pinpoint Test | DH

DH



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9591-A

STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 23, 53, 63 or 73 is received in Quick Test Step 3.0, 5.0 or 6.0.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Idle speeds/throttle stop adjustment.
- Binding throttle shaft/linkage or speed control linkage.
- Choke/high cam system, if equipped.

This Pinpoint Test is intended to diagnose only the following:

- TP sensor.
- Sensor harness circuits: VREF, TP Signal, and Signal Return.
- Processor assembly.

Throttle Position Sensor (TPS) Pinpoint Test DH

TEST STEP	RESULT ▶	ACTION TO TAKE
DH1 SERVICE CODE 23: THE FOLLOWING CHECK MUST BE MADE BEFORE SERVICING THIS CODE		
• Check for code 68; Key On, Engine Off or codes 58, 31 or 41 Engine Running.	Code(s) present ▶	DISREGARD Code 23 at this time and RETURN to Quick Test Step 3.0B for code 68 or Step 5.0B for codes 31, 41 or 58. PROCEED as directed.
	No codes present ▶	GO to DH2 .
DH2 CHECK FOR STUCK THROTTLE PLATE		
• Visually inspect carburetor/throttle body and throttle linkage for binding or sticking. • Verify the throttle linkage is at mechanical/closed throttle. Check for: binding throttle linkage, speed control linkage, vacuum line/electrical harness interference, etc.	Throttle not stuck ▶ Throttle stuck ▶	GO to DH3 . CORRECT faults. RERUN Quick Test.
DH3 GENERATE CODE 63		
• Refer to illustration DH. • Key Off, wait 10 seconds. • Disconnect TP sensor vehicle harness connector at the throttle body. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Perform Key On, Engine Off self-test and record codes. **NOTE: Ignore all other codes at this time.**	Code 63 present ▶ Code 63 not present ▶	GO to DH4 . GO to DH5 .
DH4 CHECK VOLTAGE VREF TO SIGNAL RETURN		
• Refer to illustration DH. • Key Off, wait 10 seconds. • Disconnect TP vehicle harness connector at throttle body. Inspect for damaged pins, corrosion, and pins pushed out. Service as necessary. • DVOM on 20V scale. • Key On, Engine Off. • Measure voltage at the TP vehicle harness connector between VREF and Signal Return.	Voltage reading between 4V and 6V ▶ Voltage reading less than 4V or greater than 6V ▶	REPLACE TP sensor. REFER to Section 3 before replacement for adjustment procedures for EFI applications. RERUN Quick Test. GO to Pinpoint Test Step C1 .

Throttle Position Sensor (TPS)

Pinpoint Test

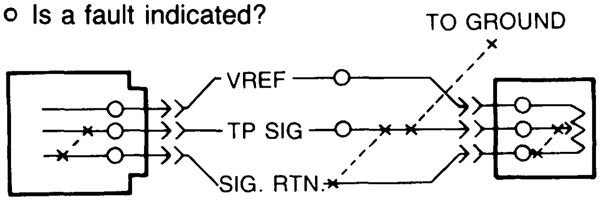
DH

TEST STEP		RESULT ▶	ACTION TO TAKE
DH5	CHECK TP SIGNAL FOR SHORT TO POWER o Key Off, wait 10 seconds TP harness disconnected. o DVOM on 200,000 ohm scale. o Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. o Install Breakout box, leave processor disconnected. o Measure resistance between test Pin 47 and test Pins 26 and 57 at the Breakout box.	Either resistance is less than 10,000 ohms ▶	SERVICE harness short. RERUN Quick Test.
		Both resistances are 10,000 ohms or greater ▶	REPLACE processor. RERUN Quick Test.
DH10	SERVICE CODE 63: GENERATE CODE 53 o Key Off, wait 10 seconds, TP harness disconnected. o Jumper VREF to TP signal at TP vehicle harness connector. o Perform Key On Engine Off self-test. **NOTE: If no codes are generated, immediately remove jumper and go directly to DH13.** o Check for Code 53 (Code 23) **NOTE: Ignore all other codes at this time.**	Code 53 present (Code 23 present) ▶	REPLACE TP sensor, REFER to Section 3 before replacement for adjustment procedures for EFI applications and RERUN Quick Test.
		Code 53 not present (Code 23 not present) ▶	GO to **DH11**.
DH11	SERVICE CODE 63: CHECK VOLTAGE VREF TO SIGNAL RETURN o Refer to illustration DH. o Key Off, wait 10 seconds. o Disconnect TP vehicle harness connector at throttle body. Inspect for damaged pins, corrosion, and pins pushed out. Service as necessary. o DVOM on 20V scale. o Key On Engine Off. o Measure voltage at the TP vehicle harness connector between VREF and Signal Return.	Voltage reading between 4V and 6V ▶	GO to **DH12**.
		Voltage reading less than 4V or greater than 6V ▶	GO to Pinpoint Test Step **C1**.

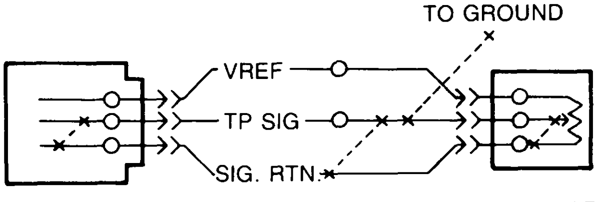
Throttle Position Sensor (TPS) | Pinpoint Test | DH

TEST STEP	RESULT ►	ACTION TO TAKE
DH12 CHECK CONTINUITY OF TP CIRCUIT		
• Key Off, wait 10 seconds, TP harness disconnected. • DVOM on 200 ohm scale. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Connect Breakout box. Processor connected to Breakout box. • Measure resistance between TP Signal at the vehicle harness connector and test Pin 47 at the Breakout box.	Reading 5 ohms or greater ►	SERVICE faulty circuit. CONNECT throttle position sensor. REMOVE Breakout box and RERUN Quick Test.
	Readings less than 5 ohms ►	GO to **DH13**.
DH13 CHECK RESISTANCE OF TP CIRCUIT TO GROUND/SIGNAL RETURN		
• Key Off, wait 10 seconds, TP harness disconnected. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • DVOM on 200,000 ohm scale. • Measure resistance between TP signal at TP vehicle harness connector and test Pin 46 at the Breakout box and between TP signal at TP vehicle harness connector and ground.	Either reading is less than 10,000 ohms ►	SERVICE circuit short and RERUN Quick Test.
	Both readings are 10,000 ohms or greater ►	REPLACE processor. CONNECT throttle position sensor. REMOVE Breakout box and RERUN Quick Test.
DH20 SERVICE CODE 73: TP SENSOR MOVES IN ENGINE RESPONSE TEST		
NOTE: Code 73 indicates the TP Sensor did not exceed 25 percent of its rotation in the Engine Response Check. • Key Off. • Install Breakout box. • DVOM on 20V scale. • Connect DVOM to test Pins 47 and 46 at the Breakout box. • Perform Engine Running Quick Test, Step 5.0. • Verify DVOM reading exceeds 3.5V during brief WOT at Engine Response Check.	Reading exceeds 3.5V during Engine Response Check ►	REPLACE processor. RERUN Quick Test.
	Reading does not exceed 3.5V during Engine Response Check ►	VERIFY TP Sensor is properly attached to throttle body. If OK, REPLACE TP Sensor. Refer to Section 3 before replacement for adjustment procedures for EFI applications. RERUN Quick Test.

Throttle Position Sensor (TPS) | Pinpoint Test | DH

TEST STEP	RESULT ▶	ACTION TO TAKE
DH90 CONTINUOUS TEST SERVICE CODE 53: EXERCISE TP SENSOR		
o Using continuous monitor mode, observe VOM or STAR LED for indication of a fault while performing the following: o Move throttle slowly to WOT position. o Release throttle slowly to closed position and lightly tap on TP sensor (simulate road shock). o Wiggle TP harness connector. o Is a fault indicated?  TO GROUND VREF TP SIG SIG. RTN. PROCESSOR HARNESS TP SENSOR A9592-A	Yes ▶ No ▶	GO to DH91. GO to DH92.
DH91 MEASURE THROTTLE POSITION SIGNAL VOLTAGE WHILE EXERCISING TP SENSOR		
o Key Off, wait 10 seconds. o Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. o Install Breakout box and reconnect processor. o VOM or STAR LED still connected to STO as in previous step. o Connect a DVOM from test Pin 47 to test Pin 46. o DVOM on 20V scale. o Key On engine Off. o While observing DVOM, repeat Step DH90. o Does the fault occur below 4.25V?	Yes ▷ No ▶	DISCONNECT and INSPECT connectors. If connector and terminals are good, REPLACE TP sensor, REFER to Shop Manual Group 24 and RERUN Quick Test. Throttle position sensor overtravel may have caused the continuous code 53. Sensor service is not required. To verify harness integrity, GO to DH92.

Throttle Position Sensor (TPS) | Pinpoint Test | DH

TEST STEP	RESULT ▶	ACTION TO TAKE
DH92 CHECK EEC-IV HARNESS		
• Observe VOM or STAR LED for a fault indication while performing the following: • Referring to the illustration in Step DH90, grasp the harness close to the sensor connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. • Is a fault indicated?	Yes ▶	ISOLATE fault and make necessary repairs. REFER to appropriate figure. RERUN Quick Test.
	No ▶	GO to **DH93**.
DH93 CHECK PROCESSOR AND HARNESS CONNECTORS		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector. • Inspect both connectors and connector terminals for obvious damage or faults. • Are connectors and terminals OK?	No ▶	SERVICE as necessary. REPEAT Quick Test.
	Yes ▶	Unable to duplicate fault at this time. Continuous code 53 testing complete.
DH94 CONTINUOUS TEST SERVICE CODE 63: EXERCISE TP SENSOR		
• Using continuous monitor mode, observe VOM or STAR LED for indication of a fault while performing the following: • Move throttle slowly to WOT position. • Release throttle slowly to closed condition. • Lightly tap on TP sensor (simulate road shock). • Wiggle TP harness connector. • Is a fault indicated?	Yes ▶	DISCONNECT and INSPECT connectors. If connector and terminals are good, REPLACE TP sensor, REFER to Shop Manual Group 24 and RERUN Quick Test.
	No ▶	GO to **DH95**.
 TO GROUND VREF TP SIG SIG. RTN PROCESSOR HARNESS TP SENSOR **A9592-A**		

Throttle Position Sensor (TPS)

Pinpoint Test

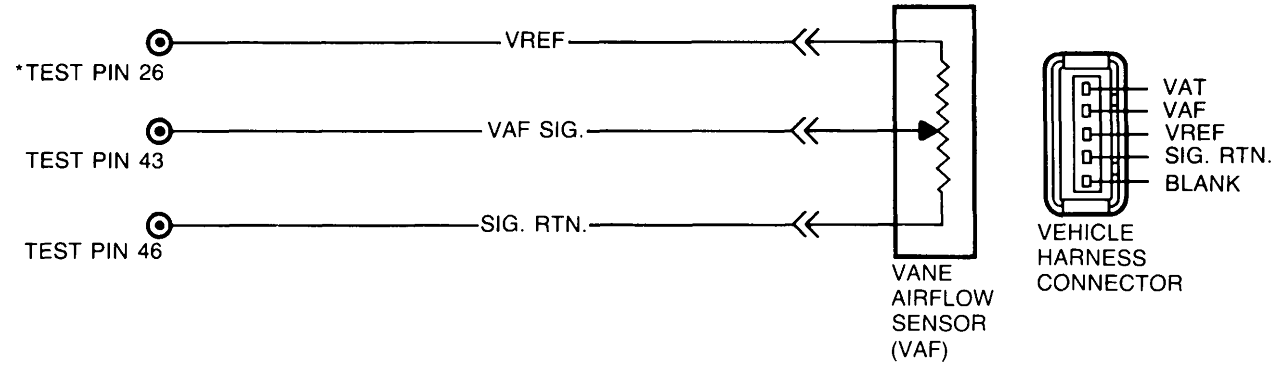
DH

TEST STEP	RESULT ▶	ACTION TO TAKE
DH95 CHECK EEC-IV HARNESS		
o Observe VOM or STAR LED for a fault indication while performing the following: o Referring to the illustration in Step DH94 grasp the harness close to the sensor connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. o Is a fault indicated?	Yes ▶	ISOLATE fault and make necessary repairs. REFER to appropriate figure. RERUN Quick Test.
	No ▶	Go to **DH96**.
DH96 CHECK PROCESSOR AND HARNESS CONNECTORS		
o Key Off, wait 10 seconds. o Disconnect processor 60 Pin connector. o Inspect both connectors and connector terminals for obvious damage or faults. o Are connectors and terminals OK?	No ▶	SERVICE as necessary. RERUN Quick Test.
	Yes ▶	Unable to duplicate fault at this time. Continuous code 63 testing complete.

Vane Airflow Sensor (VAF)

Pinpoint Test

DK



*TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9593-B

STOP-WARNING

You should enter this Pinpoint Test only when a service code 26, 56, 66 or 76 is received in Quick Test Step 3.0, 5.0 or 6.0.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Check for unmetered air (air leaks) between VAF meter and throttle body.
- Vacuum leaks.
- Engine sealing (PCV sealing, CANP, valve cover seal dipstick seated).

This Pinpoint Test is intended to diagnose only the following:

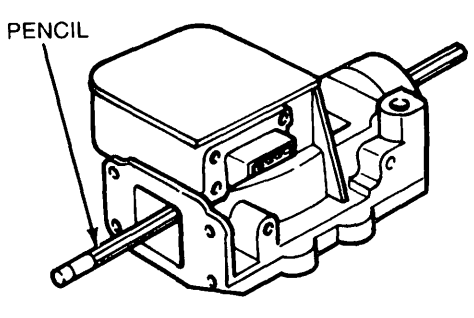
- VAF meter.
- Processor.
- Harness circuits: VREF, VAF Sig. and Signal Return.

Vane Airflow Sensor (VAF)

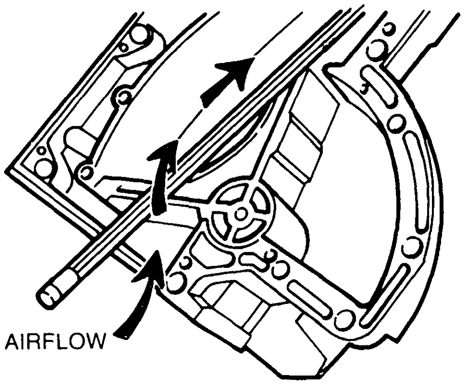
Pinpoint Test

DK

TEST STEP	RESULT ▶	ACTION TO TAKE
FAULT CODE 26		
DK1 CHECK FOR CONTAMINATION		
NOTE: Code 26 indicates the vane airflow input to the processor is out of engine off or engine idle limits (engine off 0.15-0.50V/engine idle 1.50-2.70V). There have been no opens or shorts in the VAF circuit or a code 56 (signal always high) or 66 (signal always low) would have been generated.		
● Key Off, wait 10 seconds. ● Remove air cleaner element and check for contamination (oil residue, foreign material, etc.) that may impede VAF sensor vane movement and service as necessary. ● Is service code 26 present in the Key On Engine Off portion of Quick Test?	Yes ▶ No ▶	REPLACE vane meter. RERUN Quick Test. GO to DK2.
DK2 VAF SENSOR CHECK		
● Key Off, air cleaner element reinstalled. ● Check for unmetered air leaks between vane meter and throttle body. ● Disconnect processor 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. ● Install Breakout box. Connect processor to Breakout box harness. ● DVOM on 20V scale. ● Key On, engine Off. ● Place new unsharpened pencil as shown below. ● Measure voltage between test Pins 43 (test Pin 27 on 2.3L EFI TC) and 46 at the Breakout box. ● Is voltage between 2.8V and 3.7V?	Yes ▶ No ▶	Vane meter is capable of outputting an acceptable signal. The VAF code 26 has been caused by incorrect engine speed or an unmetered air leak (vacuum leak). SERVICE as necessary. REMOVE Breakout box. RERUN Quick Test. REMOVE Breakout box. REPLACE processor. RERUN Quick Test.



VANE METER



VAF SENSOR AIR VANE A9594-B

Vane Airflow Sensor (VAF) | Pinpoint Test | DK

TEST STEP	RESULT ►	ACTION TO TAKE
FAULT CODE 56		
DK10 INDUCE OPPOSITE CODE		
• Key Off, wait 10 seconds. • Disconnect vehicle harness from vane meter. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Run Key On Engine Off Quick Test. • Is code 66 present? **NOTE: Disconnecting vane meter disconnects both VAF and VAT sensors. A code 58 should also be present. Disregard all codes except VAF codes at this time.**	Yes ► No ►	GO to DK11. GO to DK12.
DK11 CHECK VAF TO SIGNAL RETURN VOLTAGE		
• Key Off, wait 10 seconds. • Harness disconnected from vane meter. • Key On, Engine Off. • DVOM on 20V scale. • Measure voltage at the vane meter vehicle harness connector between VREF and Signal Return. • Is voltage between 4.0 and 6.0 volts?	Yes ► No ►	REPLACE vane meter. RECONNECT harness. RERUN Quick Test. GO to Pinpoint Test Step C1.
DK12 CHECK VAF SIGNAL FOR SHORT		
• Key Off, wait 10 seconds. • Harness disconnected from vane meter. • Disconnect processor 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Install Breakout box, leave processor disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 43 (test Pin 27 on 2.3L EFI TC) and test Pins 26 and 57 at the Breakout box. • Are both resistances greater than 10,000 ohms?	Yes ► No ►	REPLACE processor. REMOVE Breakout box. RECONNECT processor and vane meter. RERUN Quick Test. SERVICE circuit shorts. REMOVE Breakout box. RECONNECT processor and vane meter. RERUN Quick Test.

Vane Airflow Sensor (VAF) | Pinpoint Test | DK

TEST STEP	RESULT ▶	ACTION TO TAKE
FAULT CODE 66		
DK20 INDUCE OPPOSITE CODE		
◎ Key Off, wait 10 seconds. ◎ Disconnect vehicle harness from vane meter. ◎ Install jumper wire in vane meter vehicle harness connector between VREF and VAF signal. ◎ Perform Key On Engine Off Self-Test. **NOTE: If no codes are generated, immediately remove jumper and go directly to DK23.** ◎ Is code 56 present? **NOTE: Disconnecting vane meter disconnects both VAF and VAT sensors. Code 58 should also be present. Disregard all codes except VAF codes at this time.**	Yes ▶	REPLACE vane meter. REMOVE jumper wire. RECONNECT vane meter. RERUN Quick Test.
	No ▶	REMOVE jumper wire and GO to DK21.
DK21 CHECK VREF TO SIGNAL RETURN VOLTAGE		
◎ Key off, wait 10 seconds. ◎ Harness disconnected from vane meter. o Key On, Engine Off. o DVOM on 20V scale. ◎ Measure voltage at the vane meter vehicle harness connector between VREF and Signal Return. ◎ Is voltage between 4.0 and 6.0 volts?	Yes ▶	GO to DK22.
	No ▶	GO to Pinpoint Test Step C1.
DK22 CHECK CONTINUITY OF VAF SIGNAL		
o Key Off, harness disconnected from vane meter. ◎ Disconnect processor 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. ◎ Install Breakout box; leave processor disconnected. ◎ DVOM on 200 ohm scale. ◎ Measure resistance between VAF signal, at the vane meter vehicle harness connector, and test Pin 43 (test Pin 27 on 2.3L EFI TC) at the Breakout box. o Is resistance greater than 5 ohms?	Yes ▶	SERVICE circuit open. REMOVE Breakout box. RECONNECT processor and vane meter. RERUN Quick Test.
	No ▶	GO to DK23.

Vane Airflow Sensor (VAF)

Pinpoint Test

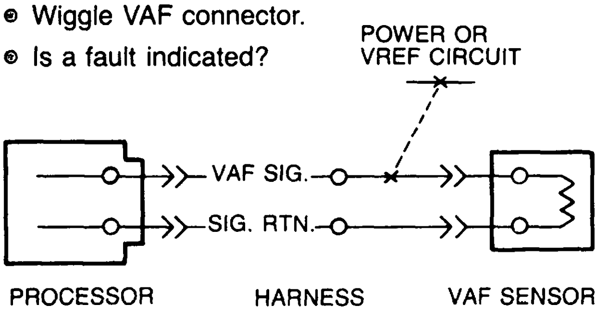
DK

TEST STEP	RESULT ▶	ACTION TO TAKE
DK23 CHECK VAF SIGNAL FOR SHORT		
• Key Off, wait 10 seconds. • Processor disconnected. • Harness disconnected from vane meter. • DVOM on 200,000 ohm scale. • Measure resistance at the vane meter vehicle harness between VAF signal and signal return and between VAF signal and negative battery terminal. • Are both resistances greater than 10,000 ohms?	Yes ▶	REPLACE processor. REMOVE Breakout box. RECONNECT processor and vane meter. RERUN Quick Test.
	No ▶	SERVICE circuit shorts. RECONNECT vane meter. RERUN Quick Test.
FAULT CODE 76		
DK30 CHECK FOR VOLTAGE INCREASE IN VAF SIGNAL TO SIGNAL RETURN		
NOTE: A sharp snap of the throttle may not be sufficient to pass this test. Be sure to move throttle to WOT and return.		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Install Breakout box. Connect processor to Breakout box harness. • DVOM on 20V scale. • Connect DVOM to test Pins 43 (test Pin 27 on 2.3L EFI TC) and 46. • Perform Engine Running Quick Test while monitoring DVOM. • After dynamic response prompt code 1(0) operator does a brief WOT. DVOM should increase more than 2.0V from reading before WOT. • Observe service codes at end of test. • Did voltage increase more than 2.0 volts?	Yes ▶	GO to DK31.
	No ▶	CHECK air cleaner duct for obstruction. If OK, REPLACE vane meter.
DK31 CHECK PROCESSOR		
• Observe Key On Engine Running service codes at end of Pinpoint Test DK30. • Is code 76 present?	Yes ▶	REPLACE processor. REMOVE Breakout box. RERUN Quick Test.
	No ▶	Vane meter is OK, SERVICE other codes as necessary.

Vane Airflow Sensor (VAF)

Pinpoint Test

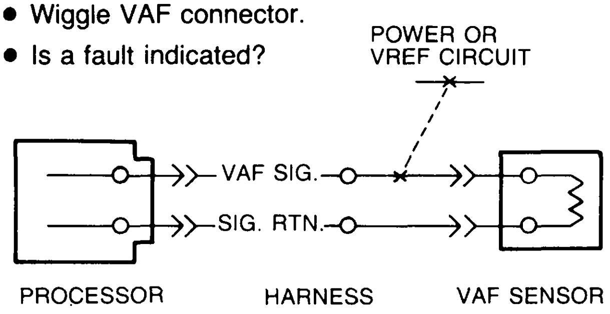
DK

TEST STEP	RESULT ▶	ACTION TO TAKE
DK90 SERVICE CODE 56 CONTINUOUS TEST: CHECK VAF SENSOR		
- Using continuous monitor mode, observe VOM or STAR LED for indication of a fault while performing the following: - Lightly tap on VAF sensor (simulate road shock). - Wiggle VAF connector.	Yes ▶	DISCONNECT and INSPECT connectors. If connector and terminals are good, REPLACE VAF sensor. RERUN Quick Test.
- Is a fault indicated?  POWER OR VREF CIRCUIT VAF SIG. SIG. RTN. PROCESSOR HARNESS VAF SENSOR A9595-A	No ▶	GO to **DK91**.
DK91 CHECK EEC-IV HARNESS		
- Observe VOM or STAR LED for a fault indication while performing the following: - Referring to the illustration in Step DK90, grasp the harness close to the sensor connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor.	Yes ▶	ISOLATE fault and make necessary repairs. REFER to appropriate figure. RERUN Quick Test.
- Is a fault indicated?	No ▶	GO to **DK92**.
DK92 CHECK PROCESSOR AND HARNESS CONNECTORS		
- Key Off, wait 10 seconds. - Disconnect processor 60 Pin connector. - Inspect both connectors and connector terminals for obvious damage or faults.	Yes ▶	Unable to duplicate fault at this time. Continuous code 56 testing complete.
- Are connectors and terminals OK?	No ▶	SERVICE as necessary. RERUN Quick Test.

Vane Airflow Sensor (VAF)

Pinpoint Test

DK

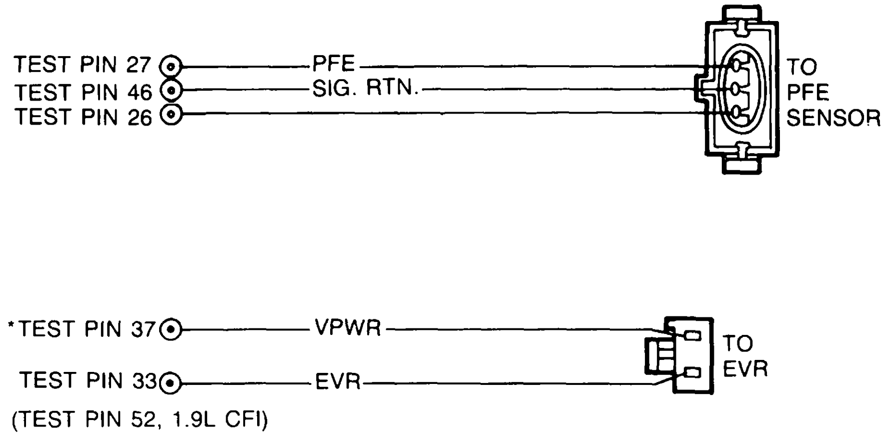
TEST STEP	RESULT ▶	ACTION TO TAKE
DK93 SERVICE CODE 66 CONTINUOUS TEST: CHECK VAF SENSOR		
• Using continuous monitor mode, observe VOM or STAR LED for indication of a fault while performing the following: • Lightly tap on VAF sensor (simulate road shock). • Wiggle VAF connector. • Is a fault indicated?	Yes ▶	DISCONNECT and INSPECT connectors. If connector and terminals are good, REPLACE sensor. RERUN Quick Test.
 POWER OR VREF CIRCUIT VAF SIG. SIG. RTN. PROCESSOR HARNESS VAF SENSOR A9595-A	No ▶	GO to **DK94**.
DK94 CHECK EEC-IV HARNESS		
• Observe VOM or STAR LED for a fault indication while performing the following: • Referring to the illustration in Step DK93 grasp the harness close to the sensor connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. • Is a fault indicated?	Yes ▶	ISOLATE fault and make necessary repairs. REFER to appropriate figure. RERUN Quick Test.
	No ▶	Go to **DK95**.
DK95 CHECK PROCESSOR AND HARNESS CONNECTORS		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector. • Inspect both connectors and connector terminals for obvious damage or faults. • Are connectors and terminals OK?	No ▶	SERVICE as necessary. RERUN Quick Test.
	Yes ▶	Unable to duplicate fault at this time. Continuous code 66 testing complete.

Pressure Feedback EGR (PFE) EGR Valve Regulator (EVR)

Pinpoint Test

DL

DL



*TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9596-B

STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 31, 32, 33, 34, 35 or 84 is received in Quick Test Step 3.0, 5.0 or 6.0.

To prevent the replacement of good components, be aware that the following non-EEC area may be at fault:

- Damaged EGR valve.

This Pinpoint Test is intended to diagnose only the following:

- PFE sensor.
- Harness circuits: VREF, PFE, Signal Return, EVR, VPWR.
- EVR (EGR valve regulator).
- EGR valve assembly.
- Processor assembly.

Pressure Feedback EGR (PFE) EGR Valve Regulator (EVR)

Pinpoint Test

DL

TEST STEP	RESULT ▶	ACTION TO TAKE
SERVICE CODE 31		
DL1 ATTEMPT TO GENERATE OPPOSITE CODE (35)		
• Key Off. • Disconnect PFE vehicle harness at sensor. • Jumper VREF to PFE signal at vehicle harness sensor connector. • Perform Key On Engine Off Self-Test. **NOTE: If no codes are generated, immediately remove jumper and GO directly to Step DL4.** • Is code 35 present? **NOTE: Ignore all other codes at this time.**	Yes ▶ No ▶	REMOVE Jumper. REPLACE PFE sensor. RERUN Quick Test. REMOVE jumper. GO to DL2.
DL2 MEASURE VREF TO SIGNAL RETURN VOLTAGE		
• Key Off. • PFE harness disconnected. • DVOM on 20V scale. • Key On Engine Off. • Measure voltage at PFE vehicle harness connector between VREF and Signal Return. • Is voltage reading between 4 and 6 volts? • Refer to illustration DL.	Yes ▶ No ▶	GO to DL3. GO to C1.
DL3 CHECK CONTINUITY OF PFE SIGNAL		
• Key Off. • PFE harness disconnected. • DVOM on 200 ohm scale. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Connect Breakout box to harness. Processor connected to Breakout box. • Measure resistance between PFE signal at vehicle harness sensor connector and test Pin 27 at the Breakout box. • Is resistance reading 5 ohms or greater?	Yes ▶ No ▶	SERVICE faulty circuit. CONNECT PFE sensor. REMOVE Breakout box. RERUN Quick Test. GO to DL4.

Pressure Feedback EGR (PFE) EGR Valve Regulator (EVR)

Pinpoint Test

DL

TEST STEP	RESULT ►	ACTION TO TAKE
DL4 CHECK RESISTANCE OF PFE SIGNAL TO GROUND AND SIGNAL RETURN ○ Key Off. ○ PFE harness disconnected. ○ Breakout box installed. ○ Processor disconnected. ○ DVOM on 200,000 ohm scale. ○ Measure resistance between PFE signal at PFE vehicle harness connector and ground. ○ Measure resistance between PFE signal at the PFE vehicle harness connector and test Pin 46 (Signal Return) at the Breakout box. ○ Is either resistance reading less than 10,000 ohms?	Yes ►	SERVICE short circuit. CONNECT PFE. REMOVE Breakout box. RERUN Quick Test.
	No ►	REPLACE processor. CONNECT PFE sensor. REMOVE Breakout box. RERUN Quick Test.
SERVICE CODE 35 **DL5** ATTEMPT TO GENERATE OPPOSITE CODE (31) ○ Key Off. ○ Disconnect PFE vehicle harness at sensor. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. ○ Perform Key On Engine Off Self-Test, and record codes. ○ Is code 31 present? **NOTE: Ignore all other codes at this time.**	Yes ►	GO to DL6.
	No ►	GO to DL7.
DL6 MEASURE VREF TO SIGNAL RETURN VOLTAGE ○ Key Off. ○ PFE harness disconnected. ○ DVOM on 20V scale. ○ Key On Engine Off. ○ Measure voltage at PFE vehicle harness connector between VREF and Signal Return. ○ Is voltage reading between 4 and 6 volts? ○ Refer to illustration DL.	Yes ►	REPLACE PFE sensor. RERUN Quick Test.
	No ►	GO to C1.

Pressure Feedback EGR (PFE) EGR Valve Regulator (EVR)

Pinpoint Test

DL

TEST STEP	RESULT ▶	ACTION TO TAKE
DL7 CHECK PFE CIRCUIT FOR SHORT TO POWER		
• Key Off. • PFE harness disconnected. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Install Breakout box, leave processor disconnected. • DVOM on 200,000 ohm scale. • Measure the resistance between test Pin 27 and test Pins 26 and 57 at the Breakout box. • Is either resistance reading less than 10,000 ohms?	Yes ▶	SERVICE harness short. REMOVE Breakout box. CONNECT PFE sensor. RERUN Quick Test.
	No ▶	REPLACE processor. REMOVE Breakout box. CONNECT PFE sensor. RERUN Quick Test.
SERVICE CODE: 34		
DL8 PFE SENSOR OUT OF RANGE		
• PFE system can sense a lack of pressure in the vehicle exhaust system. An efficient garage exhaust ventilation system, installed during Key On Engine Off Quick Test, may deflect the PFE sensor and generate a code 34. Remove the ventilation system and retest. • Is code 34 present?	Yes ▶	GO to **DL9**.
	No ▶	ADDRESS any other codes in Key On, Engine Off, if none CONTINUE with remaining Quick Test.
DL9 CHECK PRESSURE FEED TUBE TO PFE SENSOR		
• Remove the pressure feed tube from PFE sensor. • Inspect complete tube, including PFE inlet for blockage. • Is blockage present?	Yes ▶	SERVICE as necessary. RERUN Quick Test.
	No ▶	GO to **DL10**.

PLEASE REFER TO TSB 87-20-16 FOR: EEC-IV PINPOINT TESTS DL AND DN.

Pressure Feedback EGR (PFE) EGR Valve Regulator (EVR)

Pinpoint Test

DL

TEST STEP	RESULT ▶	ACTION TO TAKE
DL10 MEASURE VREF TO SIGNAL RETURN VOLTAGE o Key Off. o Disconnect PFE sensor and inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. o DVOM on 20V scale. o Key On Engine Off. o Measure voltage at PFE vehicle harness connector between VREF and Signal Return. o Is voltage reading between 4 and 6 volts? o Refer to illustration DL.	Yes ▶	REPLACE PFE sensor. RERUN Quick Test.
	No ▶	GO to Pinpoint Test C1.
SERVICE CODE 84 **DL11** MEASURE EVR SOLENOID RESISTANCE o Key Off. o DVOM on 200 ohms scale. o Disconnect EVR solenoid connector and measure solenoid resistance. o Is resistance reading between 30 and 70 ohms?	Yes ▶	GO to DL12.
	No ▶	REPLACE EVR solenoid assembly. RERUN Quick Test.
DL12 CHECK FOR VPWR AT EVR SOLENOID o EVR solenoid disconnected from harness. o DVOM on 20V scale. o Key on Engine Off. o Measure voltage between battery negative terminal and VPWR circuit at EVR solenoid vehicle harness connector. o Is voltage reading less than 10.5 volts?	Yes ▶	SERVICE VPWR open circuit. RERUN Quick Test.
	No ▶	GO to DL13.
DL13 CHECK CONTINUITY OF EVR CIRCUIT o Key Off. o EVR solenoid disconnected from harness. o Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. o Install Breakout box to processor harness connector. Leave processor disconnected. o DVOM on 200 ohm scale. o Measure resistance between test Pin 33 at the Breakout box and EVR signal at the EVR solenoid vehicle harness connector. o Is resistance reading less than 5 ohms?	Yes ▶	GO to DL14.
	No ▶	SERVICE open circuit. REMOVE Breakout box. CONNECT process EVR solenoid. RERUN Quick Test.

PLEASE REFER TO TSB **87-20-16** FOR EEC-IV PINPOINT TESTS DL AND DN.

Pressure Feedback EGR (PFE) EGR Valve Regulator (EVR)

Pinpoint Test

DL

TEST STEP	RESULT ▶	ACTION TO TAKE
DL14 CHECK EVR CIRCUIT FOR SHORT TO POWER AND GROUND		
• Key Off. • Breakout box installed, processor disconnected. • EVR solenoid disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 33 (EVR) and test Pins 37 and 57 (VPWR) and 40, 46 and 60 (GRD) at the Breakout box. • Are any readings less than 10,000 ohms?	Yes ▶	SERVICE short circuit. REMOVE Breakout box. RECONNECT harness to processor and EVR solenoid. RERUN Quick Test. If code is repeated, REPLACE processor.
	No ▶	REPLACE processor. REMOVE Breakout box. RECONNECT harness to processor and EVR solenoid. RERUN Quick Test.
SERVICE CODE 32		
DL20 VERIFY ENGINE RUNNING CODES		
The PFE system can sense a lack of pressure in the vehicle exhaust system. An efficient garage exhaust ventilation system installed during Key On Engine Run Quick Test may, on some calibrations, deflect the PFE sensor and generate a code 32. Temporarily, remove garage forced ventilation system and properly vent to atmosphere. • RERUN Engine Running Quick Test. • Is code 32 present?	Yes ▶	GO to **DL21**.
	No ▶	ADDRESS any other codes in Engine Running. If none, CONTINUE with remaining Quick Test.

PLEASE REFER TO TSB 87-20-16 FOR: EEC-IV PINPOINT TESTS DL AND DN.

Pressure Feedback EGR (PFE) EGR Valve Regulator (EVR)

Pinpoint Test

DL

TEST STEP	RESULT ▶	ACTION TO TAKE
DL21 ATTEMPT TO SEPARATE EVR FROM PFE		
o Key Off. o Disconnect EGR valve vacuum line at valve and plug line. o Perform Engine Running Quick Test. o Is code 31 or 32 present?	Yes ▶	GO to DL22.
	No ▶	GO to DL23.
DL22 CHECK PFE SENSOR SUPPLY TUBE		
o Key Off. o Check PFE sensor supply tube for obstructions and/or leaks. o Are there any obstructions or leaks?	Yes ▶	SERVICE as necessary. RECONNECT all lines and RERUN Quick Test.
	No ▶	GO to EGR Diagnostic, Section 6.
DL23 CHECK EVR FILTER		
o Key Off. o Remove and inspect EVR filter for contamination. **NOTE: Blockage of filter will cause vacuum to be applied to EGR valve prematurely.** o Is filter contaminated?	Yes ▶	REPLACE filter. RECONNECT all lines. RERUN Quick Test.
	No ▶	REPLACE EVR solenoid. RERUN Quick Test.
ENGINE RUNNING SERVICE CODE 34 AND 35		
DL25 CHECK FOR EXCESSIVE EXHAUST BACK PRESSURE		
o Service codes 34 and 35 in Engine Running Self-Test indicate excessive exhaust back pressure; There are two possible causes: (A). The exhaust system is restricted, and (B). PFE sensor has shifted high. o Key Off. o Substitute known good PFE sensor in place of original. o Rerun Key On Engine Running Quick Test. o Is code 34 or 35 present?	Yes ▶	GO to Section 5, Catalyst and Exhaust Systems Restricted Exhaust System Diagnosis.
	No ▶	Original PFE was the cause of the original 34 or 35. REPLACE PFE sensor. RERUN Quick Test.

PLEASE REFER TO TSB 87-20-16 FOR EEC-IV PINPOINT TESTS DL AND DN.

Pressure Feedback EGR (PFE) EGR Valve Regulator (EVR)

Pinpoint Test

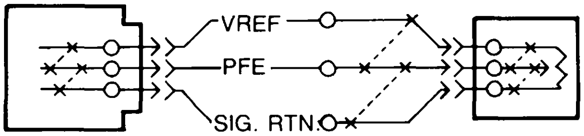
DL

TEST STEP	RESULT ▶	ACTION TO TAKE
SERVICE CODE 33		
DL30 VERIFY VACUUM IS PRESENT AT VALVE		
• Key Off. • Standard vacuum gauge in. Hg (Mercury). • Tee in vacuum gauge at EGR valve. • Perform Engine Running Quick Test while observing vacuum gauge. • Is vacuum reading 1 in.-Hg. or less? **NOTE: Disregard code output.**	Yes ▶ No ▶	GO to **DL31**. GO to **DL34**.
DL31 VACUUM SUPPLY VERIFICATION		
• Key Off. • Do vacuum lines from EVR solenoid to EGR valve and source to EVR solenoid have loose connections, cracks or obstructions?	Yes ▶ No ▶	SERVICE as necessary. RERUN Quick Test. GO to **DL32**.
DL32 VERIFY VACUUM TO EVR		
• Key On Engine Running. • Attach vacuum gauge to source line from manifold. • Is vacuum present?	Yes ▶ No ▶	REPLACE EVR solenoid. RERUN Quick Test. REPLACE vacuum line to EVR. RERUN Quick Test.
DL34 CHECK EGR CONTROL PFE SENSOR TUBE		
• Key Off. • Is control pressure input tube to PFE sensor cracked, disconnected or obstructed?	Yes ▶ No ▶	SERVICE as necessary. RERUN Quick Test. REPLACE PFE Sensor. RERUN Quick Test.

Pressure Feedback EGR (PFE) EGR Valve Regulator (EVR)

Pinpoint Test

DL

TEST STEP	RESULT ▶	ACTION TO TAKE
DL90 SERVICE CODE 31 OR 35 CONTINUOUS TEST: EXERCISE PFE SENSOR		
o Using continuous monitor mode, observe VOM or STAR LED for indication of a fault while performing the following: o Connect a vacuum pump to the PFE sensor. o Slowly apply 5 in.-Hg. to the sensor. o Slowly bleed vacuum off the PFE sensor. o Lightly tap on PFE sensor (simulate road shock). o Wiggle PFE connector. o Is fault indicated?	Yes ▶	DISCONNECT and INSPECT connectors. If connector and terminals are good, REPLACE sensor. RERUN Quick Test.
 A9597-A	No ▶	GO to DL91.

Pressure Feedback EGR (PFE) EGR Valve Regulator (EVR)

Pinpoint Test

DL

TEST STEP	RESULT ▶	ACTION TO TAKE
DL91 CHECK EEC-IV HARNESS		
• Observe VOM or STAR LED for a fault indication while performing the following: • Referring to the illustration in Step DL90 grasp the harness closest to the sensor connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. • Is a fault indicated?	Yes ▶	ISOLATE fault and SERVICE as necessary. RERUN Quick Test.
	No ▶	GO to DL92.
DL92 CHECK PROCESSOR AND HARNESS CONNECTORS		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector. • Inspect both connectors and connector terminals for obvious damage or faults. • Are connectors and terminals OK?	Yes ▶	Unable to duplicate and/or identify fault at this time. Continuous code 31 or 35 testing complete.
	No ▶	SERVICE as necessary. RERUN Quick Test.
DL93 SERVICE CODE 34: CONTINUOUS TEST — INSPECT PFE SUPPLY TUBE FOR BLOCKAGE		
• Key Off. • Remove PFE sensor and inspect sensor supply inlet for liquids and/or any type of blockage. • Inspect PFE supply tube to EGR valve base for liquids and/or blockage. • Is supply tube free of any blockage?	Yes ▶	Unable to duplicate and/or identify fault at this time. Continuous code 34 testing complete.
	No ▶	CLEAN and/or SERVICE as necessary. RERUN Quick Test.

Pressure Feedback EGR (PFE) EGR Valve Regulator (EVR)

Pinpoint Test

DL

TEST STEP	RESULT ▶	ACTION TO TAKE
DL94 SERVICE CODE 32: CONTINUOUS TEST — INSPECT EGR VALVE FOR SMOOTH OPERATION.		
○ Key Off. ○ Connect a vacuum pump to the EGR valve. ○ Apply 10 in.-Hg. of vacuum to EGR valve. ○ While observing EGR valve, release vacuum. ○ Does EGR valve function in a smooth manner? **NOTE: Repeat test if necessary to ensure accurate result.**	Yes ▶	GO to DL95.
	No ▶	GO to EGR Valve Diagnostic Section 6.
DL95 INSPECT VACUUM LINES BETWEEN EVR SOLENOID AND EGR VALVE		
○ Inspect EGR valve vacuum supply line from EVR solenoid for kinks and/or obstructions. ○ Is vacuum supply line to EGR valve free of any obstructions?	Yes ▶	GO to DL96.
	No ▶	SERVICE as necessary. RERUN Quick Test.
DL96 EVR REGULATOR FILTER INSPECTION		
○ Carefully check EVR filter for contamination and/or obstructions. ○ Is EVR filter condition acceptable?	Yes ▶	Unable to duplicate and/or identify fault at this time. Continuous code 34 testing complete.
	No ▶	REPLACE EVR filter. RERUN Quick Test.
DL97 SERVICE CODE 33: CONTINUOUS TEST — INSPECT EGR VALVE FOR FREE OPERATION		
○ Key Off. ○ Connect a vacuum pump to the EGR valve. ○ While observing the EGR valve, slowly apply 10 in.-Hg. vacuum. **NOTE: EGR valve should begin to open with a very small amount of vacuum, approximately 1 to 1.5 in.-Hg. and be fully open with about 4 in.-Hg. vacuum.** ○ Does EGR valve move freely and smoothly?	Yes ▶	GO to DL98.
	No ▶	GO to EGR Valve Diagnostic Section 6.

Pressure Feedback EGR (PFE) EGR Valve Regulator (EVR)

Pinpoint Test

DL

TEST STEP	RESULT ▶	ACTION TO TAKE
DL98 EVR HARNESS CHECK		
• Key Off. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Connect Breakout box to harness. Processor connected to Breakout box. • Enter output state check. • DVOM on 20 V scale. • Connect DVOM negative test lead to test Pin 40 at the Breakout box and DVOM positive test lead to test Pin 33. • Cycle throttle if necessary to indicate 10.5 V or greater. • Remain at this position. • While observing DVOM, grasp the harness closest to the EVR connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Lightly tap EVR solenoid to simulate road vibration. • Does DVOM indicate less than 10.5 V?	Yes ▶	SERVICE as necessary. RERUN Quick Test.
	No ▶	Unable to duplicate and/or identify fault at this time. Continuous code 33 testing complete.

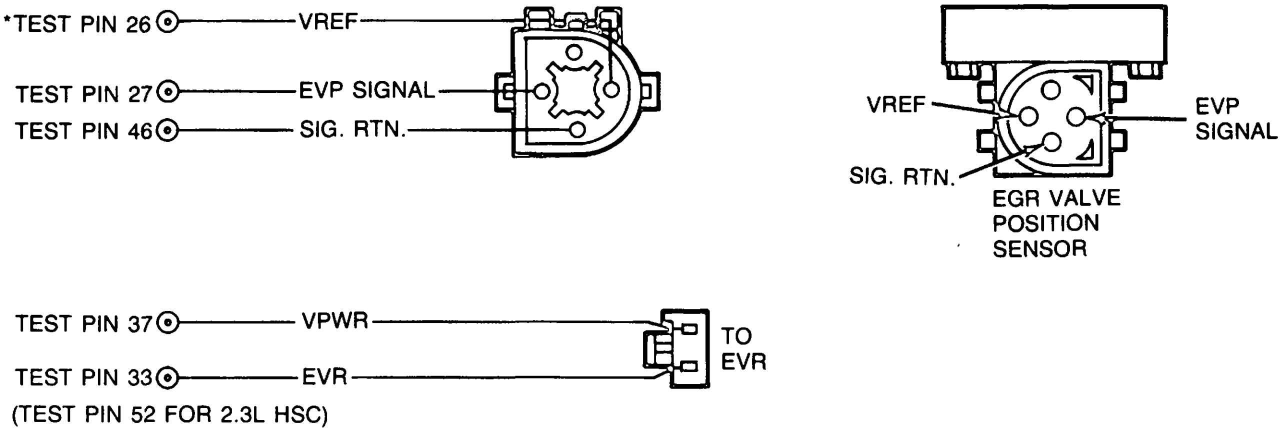
PLEASE REFER TO TSB 87-20-16 FOR EEC-IV PINPOINT TESTS DL AND DN.

EGR Valve Position Sensor (EVP) EGR Valve Regulator (EVR)

Pinpoint Test

DN

DN



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9599-B

STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 31, 32, 33, 34, 35, 38 or 84 is received in Quick Test Step 3.0, 5.0 or 6.0.

To prevent the replacement of good components, be aware that the following non-EEC area may be at fault:

- o Damaged EGR valve.

This Pinpoint Test is intended to diagnose only the following:

- o EVP sensor.
- o Harness circuits: VREF, EVP, Signal Return, EVR, VPWR.
- o EVR (EGR valve regulator).
- o EGR valve assembly.
- o Processor assembly.
- o EGR and EVR vacuum lines.

PLEASE REFER TO TSB 87-20-16 FOR EEC-IV PINPOINT TESTS DL AND DN

EGR Valve Position Sensor (EVP) EGR Valve Regulator (EVR)

Pinpoint Test

DN

TEST STEP	RESULT ▶	ACTION TO TAKE
SERVICE CODE: 31		
DN1 ATTEMPT TO GENERATE CODE (35)		
• Key Off. • Disconnect EVP vehicle harness at sensor. • Jumper VREF to EVP signal at vehicle harness sensor connector. • Perform Key On Engine Off Self-Test. • Is code 35 present? **NOTE: Ignore all other codes at this time.**	Yes ▶ No ▶	REPLACE EVP sensor. RERUN Quick Test. REMOVE jumper. GO to DN2.
DN2 MEASURE VOLTAGE BETWEEN VREF AND SIGNAL RETURN		
• Key Off. • EVP disconnected from harness. • DVOM on 20 V scale. • Key on, engine off. • Measure voltage at EVP vehicle harness connector between VREF and Signal Return. • Is voltage between 4 and 6 volts?	Yes ▶ No ▶	GO to DN3. GO to C1.
DN3 CHECK CONTINUITY OF EVP SIGNAL		
• Key Off, EVP harness disconnected. • DVOM on 200 ohm scale. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Connect Breakout box to harness. Processor connected to Breakout box. • Measure resistance between EVP signal at vehicle harness connector and test Pin 27 at the Breakout box. • Is resistance 5 ohms or less?	Yes ▶ No ▶	GO to DN4. SERVICE open circuit. CONNECT EVP sensor. REMOVE Breakout box. RERUN Quick Test.

EGR Valve Position Sensor (EVP) EGR Valve Regulator (EVR)

Pinpoint Test

DN

TEST STEP	RESULT ▷	ACTION TO TAKE
DN4 CHECK RESISTANCE OF EVP SIGNAL TO GROUND AND SIGNAL RETURN		
o Key Off. o EVP harness disconnected. o Breakout box installed. o Processor disconnected. o DVOM on 200,000 ohm scale. o Measure resistance between EVP signal at EVP vehicle harness connector and ground. o Measure resistance between EVP signal at EVP vehicle harness connector and test Pin 46 (Signal Return) at the Breakout box. o Are both resistances greater than 10,000 ohms?	Yes ▷	REPLACE processor. CONNECT EVP sensor. REMOVE Breakout box. RERUN Quick Test.
	No ▷	SERVICE short circuit. CONNECT EVP. REMOVE Breakout box. RERUN Quick Test.
SERVICE CODE: 35		
DN5 ATTEMPT TO GENERATE CODE 31		
o Key Off. o Disconnect EVP vehicle harness at sensor. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. Leave EVP sensor disconnected. o Perform Key On Engine Off Self-Test, and record codes. o Is code 31 present? **NOTE: Ignore all other codes at this time.**	Yes ▷	GO to DN6.
	No ▷	GO to DN7.
DN6 MEASURE VREF TO SIGNAL RETURN VOLTAGE		
o Key Off. o EVP harness disconnected. o DVOM on 20V scale. o Key on, engine off. o Measure voltage at EVP vehicle harness connector between VREF and Signal Return. o Is voltage between 4.0 and 6.0 volts?	Yes ▷	REPLACE EVP sensor. RERUN Quick Test.
	No ▷	GO to C1.

EGR Valve Position Sensor (EVP)
EGR Valve Regulator (EVR)

Pinpoint Test

DN

TEST STEP	RESULT ▶	ACTION TO TAKE
DN7 CHECK EVP CIRCUIT FOR SHORT TO POWER		
• Key Off. • EVP disconnected from harness. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Install Breakout box, leave processor disconnected. • DVOM on 200,000 ohm scale. • Measure the resistance between test Pin 27 and test Pins 26 and 57 at the Breakout box. • Are both resistances greater than 10,000 ohms?	Yes ▶ No ▶	REPLACE processor. REMOVE Breakout box. CONNECT EVP sensor. RERUN Quick Test. SERVICE harness short. REMOVE Breakout box, CONNECT EVP sensor. RERUN Quick Test.
SERVICE CODE: 84		
DN10 MEASURE EVR SOLENOID RESISTANCE		
• Key Off. • DVOM on 200 ohm scale. • Disconnect EVR solenoid connector and measure solenoid resistance. • Is resistance between 30 and 70 ohms?	Yes ▶ No ▶	GO to DN11. REPLACE EVR solenoid assembly. RERUN Quick Test.
DN11 CHECK FOR VPWR AT EVR SOLENOID		
• EVR solenoid disconnected from harness. • DVOM on 20V scale. • Key on, engine off. • Measure voltage between battery negative terminal and VPWR circuit at EVR solenoid vehicle harness connector. • Is voltage greater than 10.5 V?	Yes ▶ No ▶	GO to DN12. SERVICE VPWR open circuit. RERUN Quick Test.

EGR Valve Position Sensor (EVP) EGR Valve Regulator (EVR)

Pinpoint Test

DN

TEST STEP	RESULT ▷	ACTION TO TAKE
DN12 CHECK CONTINUITY OF EVR CIRCUIT		
o Key Off. o EVR solenoid disconnected from harness. o Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. o Install Breakout box to processor harness connector. Leave processor disconnected. o DVOM on 200 ohm scale. o Measure resistance between test Pin 33 (test Pin 52 for 2.3L HSC) at the Breakout box and EVR signal at the EVR solenoid vehicle harness connector. o Is resistance less than 5 ohms?	Yes ▷	GO to DN13.
	No ▷	SERVICE open circuit. REMOVE Breakout box. CONNECT process EVR solenoid. RERUN Quick Test.
DN13 CHECK EVR CIRCUIT FOR SHORT TO POWER AND GROUND		
o Key Off. o Breakout box installed, processor disconnected. o EVR solenoid disconnected. o DVOM on 200,000 ohm scale. o Measure resistance between test Pin 33 (test Pin 52 for 2.3L HSC) EVR signal and test Pins 37 and 57 (VPWR) and 40, 46 and 60 (GRD) at the Breakout box. o Are all resistances greater than 10,000 ohms?	Yes ▷	REPLACE processor. REMOVE Breakout box. RECONNECT processor and EVR solenoid. RERUN Quick Test.
	No ▷	SERVICE short circuit. REMOVE Breakout box. RECONNECT processor and EVR solenoid. RERUN Quick Test. If code is repeated, REPLACE processor.

EGR Valve Position Sensor (EVP)
EGR Valve Regulator (EVR)

Pinpoint Test

DN

TEST STEP	RESULT ▶	ACTION TO TAKE
DN20		
Code 34 Key On Engine Off, indicates that the EGR valve and/or EVP sensor is not fully seated in the closed position. **NOTE: Because of the preload on the installed EVP sensor, it is very difficult to determine whether the problem cause is that the EGR valve is not seated, or that the EVP sensor is not in contact with the EGR valve stem.**		
SUBSTITUTE EVP SENSOR ON ORIGINAL EGR VALVE		
• Key Off, wait 10 seconds. • Install a known good EVP sensor on original EGR valve. • Perform Key On Engine Off Self-Test. • Is code 34 present?	Yes ▶	GO to EGR Valve Diagnostic Section 6.
	No ▶	The original code 34 was the result of the original EVP sensor. SERVICE EVP sensor as necessary. RERUN Quick Test.
DN25		
Code 32 Key On Engine Off or Engine Running: indicates that the EGR valve and/or EVP sensor is lower than normal in the closed position. **NOTE: Because of the preload of the EVP sensor, it is difficult to determine whether the EGR valve has malfunctioned or if the EVP sensor has abnormally high resistance.**		
SUBSTITUTE EVP SENSOR ON ORIGINAL EGR VALVE		
• Key Off, wait 10 seconds. • Install a known good EVP sensor on original EGR valve. • Perform Key On Engine Off Self-Test. • Is code 32 present?	Yes ▶	GO to EGR Valve Diagnostic Section 6.
	No ▶	The original code 32 was the result of the original EVP sensor. SERVICE EVP sensor as necessary. RERUN Quick Test.

EGR Valve Position Sensor (EVP) EGR Valve Regulator (EVR)

Pinpoint Test

DN

TEST STEP	RESULT ▷	ACTION TO TAKE
DN40 **NOTE: Code 33 Key On Engine Running indicates that the EVP sensor reading did not change after the EVR solenoid was instructed by the processor to open the EGR valve. Items that are known:** o **EVR solenoid is electrically capable (indicated by a pass code 11 in Key On Engine Off).** o **EVP sensor was in its expected range when the EGR valve was closed.**		
VERIFY VACUUM IS PRESENT AT EGR VALVE o Key Off. o Standard vacuum gauge in.-Hg. o Tee in vacuum gauge at EGR valve. o Perform Engine Running Self-Test while observing vacuum gauge. o Is vacuum greater than 1.5 in.-Hg. (5 kPa)?	Yes ▷ No ▷	GO to DN43. GO to DN41.
DN41 VERIFY VACUUM SUPPLY TO EVR SOLENOID o Key Off. o Disconnect the vacuum source to the EVR solenoid. o Install a vacuum gauge at source vacuum line. o Start engine. o Is vacuum greater than 10 in.-Hg. (33 kPa)?	Yes ▷ No ▷	GO to DN42. CHECK source vacuum line to EVR solenoid. SERVICE as necessary. RERUN Quick Test.
DN42 CHECK VACUUM LINE FROM EVR SOLENOID TO EGR VALVE o Carefully check vacuum line for cracks, loose connector, blockage, kinks and leaks. o Is vacuum line good?	Yes ▷ No ▷	CHECK EVR solenoid filter for obstructions. REPLACE as necessary. If OK, REPLACE EVR solenoid assembly. RECONNECT all vacuum lines. RERUN Quick Test. SERVICE vacuum lines as necessary. RECONNECT vacuum lines and RERUN Quick Test.

EGR Valve Position Sensor (EVP) EGR Valve Regulator (EVR)

Pinpoint Test

DN

TEST STEP	RESULT ►	ACTION TO TAKE
DN43 SUBSTITUTE EVP SENSOR ON ORIGINAL EGR VALVE		
• Key Off, wait 10 seconds. • Install a known good EVP sensor on original EGR valve. • Perform Engine Running Self-Test. • Is code 33 present?	Yes ►	GO to EGR Valve Diagnostic Section 6.
	No ►	The original code 33 was the result of the original EVP sensor. SERVICE EVP sensor as necessary. RERUN Quick Test.
DN50 SERVICE CODE 34: EGR VALVE OPERATION, ENGINE RUNNING SELF-TEST		
• Key Off. • Disconnect vacuum hose from EGR valve and plug hose. • Perform Engine Running Self-Test. • Is code 34 present?	Yes ►	GO to **DN51**.
	No ►	CHECK EVR filter for obstructions. REPLACE as necessary. If OK, REPLACE solenoid assembly. RECONNECT all vacuum lines. RERUN Quick Test.
DN51 CHECK EVP RESISTANCE WHILE APPLYING VACUUM TO EGR VALVE		
• Key Off. • Disconnect harness from EVP sensor. Inspect for damaged pins, corrosion, and pins pushed out. Service as necessary. • DVOM on 200,000 ohm scale. • Disconnect vacuum line at EGR valve. • Connect vacuum pump to EGR valve. • Measure resistance at the EVP sensor between EVP signal and VREF while increasing vacuum to 10 in. Hg. (33 kPa). • Observe resistance as vacuum increases. • Does resistance decrease gradually from no more than 5,500 ohms to no less than 100 ohms?	Yes ►	GO to EGR Valve Diagnostic Section 6.
	No ►	REPLACE EVP sensor. RECONNECT vacuum lines.

EGR Valve Position Sensor (EVP)
EGR Valve Regulator (EVR)

Pinpoint Test

DN

TEST STEP	RESULT ►	ACTION TO TAKE
DN55		
Code 38 Engine Running indicates that after opening the EGR valve (during the Engine Running Self Test) the EGR vacuum system was unable to maintain a specific opening (EVP position).		
VERIFY EGR VALVES VACUUM HOLDING CAPABILITY		
o Key Off. o Disconnect vacuum line at EGR valve. o With a hand vacuum pump, apply 10 in.-Hg. (33 kPa) to EGR valve. o Does vacuum hold for 10 seconds?	Yes ►	GO to DN56.
	No ►	GO to EGR Valve Diagnostic Section 6.
DN56 EVR SOLENOID TO EGR VALVE VACUUM LINE VERIFICATION		
o Key off. o Closely inspect the vacuum line from the EVR solenoid to the EGR valve for any source of leakage, which would include cracks, holes, loose connections etc. o Is the vacuum line good?	Yes ►	REPLACE the EVR solenoid. RERUN Quick Test.
	No ►	SERVICE vacuum line as necessary. RERUN Quick Test.
DN60 CHECK VACUUM LINE		
o Key Off, wait 10 seconds. o Vacuum lines reconnected. o Carefully check EGR vacuum line system from EGR valve to EVR for obstructions, kinks, leaks, etc. o Is vacuum line in good condition?	Yes ►	CHECK EVR filter for obstructions. REPLACE as necessary. If OK, REPLACE EVR solenoid. RECONNECT all vacuum lines. RERUN Quick Test.
	No ►	SERVICE as necessary. RERUN Quick Test.

EGR Valve Position Sensor (EVP) EGR Valve Regulator (EVR)

Pinpoint Test

DN

TEST STEP	RESULT ▶	ACTION TO TAKE
DN90 CODE 32 CONTINUOUS TEST		
• **Code 32: The EVP circuit indicated that the EGR valve was closed further than normal with the engine at stabilized operating temperature and at idle.**		
MEASURE EVP SIGNAL VOLTAGE WHILE EXERCISING EVP SENSOR		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Install Breakout box and reconnect processor. • Connect a vacuum pump to the EGR valve. • Connect a DVOM from test Pin 27 to test Pin 46. • DVOM on 20V scale. • Key on, engine off. • Observe DVOM. • Very slowly apply 6 in.-Hg. (20 kPa) vacuum to the EGR valve. • Slowly bleed vacuum off the EGR valve and lightly tap on EVP sensor (simulate road shock). • Are any voltage readings less than 0.29 volts?	Yes ▶ No ▶	EGR valve may have caused continuous code 32. Sensor service is not required. GO to EGR Valve Diagnostic Section 6. Unable to duplicate code 32 fault at this time. Test completed.

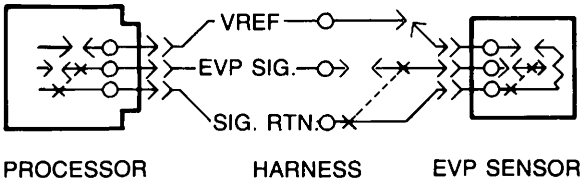
EGR Valve Position Sensor (EVP) EGR Valve Regulator (EVR)

Pinpoint Test

DN

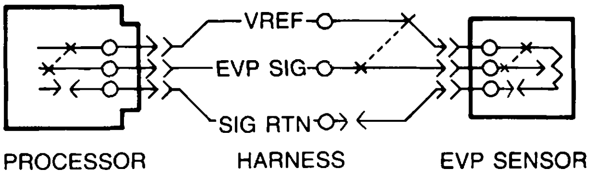
TEST STEP	RESULT ▶	ACTION TO TAKE
DN92 CODE 31 AND/OR 35 CONTINUOUS TEST		
o **Code 31: The EVP circuit indicated an open in the EVP signal or VREF, or a short to signal return with the engine at stabilized operating temperature and at idle.** o **Code 35: The EVP circuit indicated a short to VREF and/or V Power, or an open in signal return with the engine at stabilized operating temperature and at idle.**		
CHECK EEC-IV HARNESS		
o Observe VOM or STAR LED for a fault indication while performing the following: o Refer to illustration below by code for possible circuit faults. o Grasp the harness close to the sensor connector. Wiggle, shake or bend a small section of the EEV-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. o Is a fault indicated?	Yes ▶	ISOLATE fault and SERVICE as necessary. REFER to appropriate figure. RERUN Quick Test.
	No ▶	GO to **DN93**.

CODE 31:



A9600-B

CODE 35:



A9908-A

EGR Valve Position Sensor (EVP) EGR Valve Regulator (EVR)

Pinpoint Test

DN

TEST STEP	RESULT ►	ACTION TO TAKE
DN93 CHECK PROCESSOR AND HARNESS CONNECTORS		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector. • Inspect both connectors and connector terminals for obvious damage or faults. • Are connectors and terminals OK?	Yes ►	Unable to duplicate fault at this time. Continuous Code 31 or 35 testing complete.
	No ►	SERVICE as necessary. RERUN Quick Test.
DN95 CODE 33 CONTINUOUS TEST		
• **Code 33: The EVP circuit indicated that the EGR valve did not open with the engine at stabilized temperature and with an EVR solenoid duty cycle present.**		
LEAK TEST		
• Key Off. • Connect a vacuum pump to EGR valve. • Apply 20 in. Hg (66 kPa) to EGR valve. • Does EGR valve open and maintain vacuum?	Yes ►	GO to DN96.
	No ►	GO to EGR diagnostic, Section 6.
DN96 EVR CHECK		
• Using continuous monitor mode, observe VOM or STAR LED for indication of a fault while performing the following: • Grasp the harness close to the EVR solenoid connector, wiggle, shake or bend a small section of the harness while working your way to the processor. • Inspect connectors, terminals for obvious damage or faults. • Are any faults detected or indicated?	Yes ►	ISOLATE fault and SERVICE as necessary. RERUN Quick Test.
	No ►	Unable to duplicate fault at this time, testing complete.

EGR Valve Position Sensor (EVP) EGR Valve Regulator (EVR)

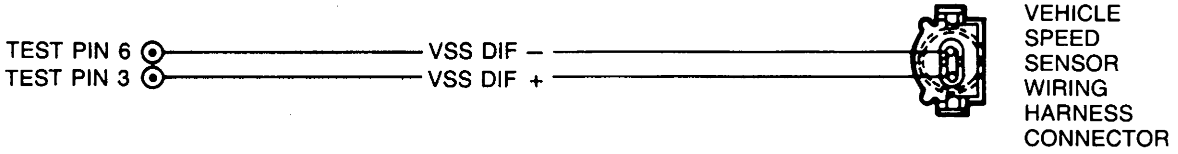
Pinpoint Test

DN

TEST STEP	RESULT ▶	ACTION TO TAKE
DN98 CODE 34 CONTINUOUS TEST		
o **Code 34: The EVP circuit indicated that the EGR valve was open with the engine at stabilized operating temperature and at idle.**		
CHECK EVP RESISTANCE WHILE APPLYING VACUUM TO EGR VALVE		
o Key Off. o Disconnect harness from EVP sensor. o Inspect for damaged pins, corrosion, and pins pushed out. Service as necessary. o DVOM on 200,000 ohm scale. o Disconnect vacuum line at EGR valve. o Connect vacuum pump to EGR valve. o Measure resistance at the EVP sensor between EVP signal Pin and VREF Pin while increasing vacuum to 10 in. Hg (33 kPa). o Observe resistance as vacuum increases. o Does resistance gradually change from no more than 5,500 ohms to no less than 100 ohms as the vacuum increases?	Yes ▶ No ▶	GO to DN99. GO to EGR Diagnostic Section 6.
DN99 EVR CHECK		
o Key Off. o Disconnect vacuum hose from EGR valve and plug hose. o Perform Engine Running Self-Test. o Is code 34 present?	Yes ▶ No ▶	CHECK EVR filter for obstructions. REPLACE as necessary. If OK, REPLACE EVR solenoid. RECONNECT all vacuum lines. RERUN Quick Test. Unable to duplicate fault at this time.

Vehicle Speed Sensor | Pinpoint Test | DP

DP



A9909-A

STOP-WARNING

You should enter this Pinpoint Test only when service codes 27 or 29 are received in Quick Test Step 6.0.

This Pinpoint Test is intended to diagnose only the following:

- VSS Harness Circuit
- Vehicle Speed Sensor
- Processor Assembly

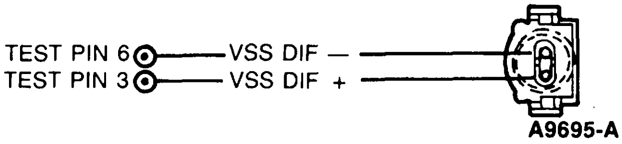
Vehicle Speed Sensor

Pinpoint Test

DP

TEST STEP	RESULT ▶	ACTION TO TAKE
DP1 DRIVE CYCLE FOR CHECKING VSS		
AUTOMATIC TRANSMISSION o Record and clear EEC-IV Self-Test continuous codes. o Warm engine to operating temperature. **NOTE: For 2.3L EFI T.C. automatic applications, engine must run without interruption for 5 minutes to enter VSS test.** o With PRNDL selector in 1st gear (low) position, accelerate moderately to 25 mph and coast down to idle and stop. Shut engine off. o Run Key On Engine Off Self-Test. Is code 29 present in continuous? (2.3L EFI T.C. uses code 27.) **MANUAL TRANSMISSION** o Record and clear EEC-IV Self-Test continuous codes. o Warm engine to operating temperature. o Starting in first gear, shift to second gear accelerate moderately to 40 mph, coast down to idle and stop. Shut engine off. o Run Key On Engine Off Self-Test. Is code 29 present in continuous? (2.3L EFI T.C. uses code 27.)	Yes ▶	GO to DP2.
	No ▶	Unable to duplicate fault at this time. If any other codes are present, return to Quick Test for directions. If codes are not present, test is completed.
DP2 SENSOR CHECK		
o Key Off, wait 10 seconds. o Locate and disconnect vehicle speed sensor. o DVOM on 200,000 ohm scale. o Measure resistance across vehicle speed sensor. o Is resistance between 190 and 240 ohms?	Yes ▶	GO to DP3.
	No ▶	REPLACE sensor. RERUN Test Step DP1.

Vehicle Speed Sensor | Pinpoint Test | DP

TEST STEP	RESULT ▶	ACTION TO TAKE
DP3 CONTINUITY OF VEHICLE SPEED SENSOR (VSS) HARNESS		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box. • Processor and VSS disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 3 at the Breakout box and the VSS vehicle harness connector as shown below. • Measure resistance between test Pin 6 at the Breakout box and the VSS vehicle harness connector, as shown below.  TEST PIN 6 VSS DIF — TEST PIN 3 VSS DIF + A9695-A • Are both resistances 5 ohms or less?	Yes ▶ No ▶	GO to **DP4**. SERVICE open(s) in VSS harness. RERUN Test Step **DP1**.
DP4 CHECK VSS HARNESS FOR SHORTS TO POWER OR GROUND		
• Key Off. • Processor disconnected. • VSS disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 3 and test Pins 37, 40 and 6 at the Breakout box. Then measure resistance between test Pin 6 and test Pins 37 and 40 (except 2.3L EFI T.C.) at the Breakout box. • Are all readings greater than 10,000 ohms?	Yes ▶ No ▶	GO to **DP5**. SERVICE short(s) in VSS harness. RERUN Test Step **DP1**.

Vehicle Speed Sensor

Pinpoint Test

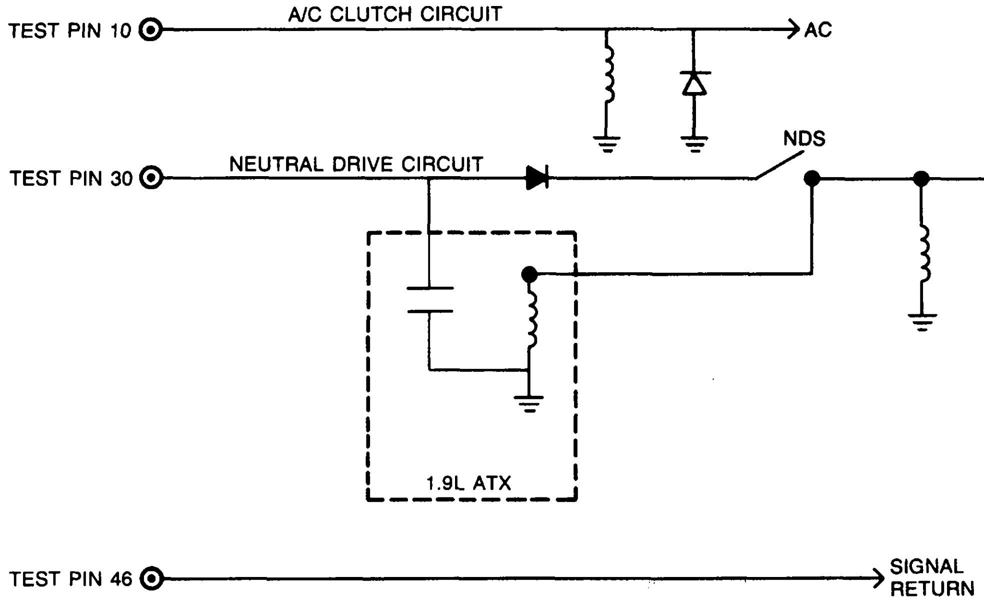
DP

TEST STEP	RESULT ▶	ACTION TO TAKE
DP5 SUBSTITUTE VEHICLE SPEED SENSOR (VSS)		
• Substitute VSS with known good sensor. • Processor and VSS connected. • Perform Drive Cycle outlined in Test Step DP1 then return to this Step. • Is code 29 (for 2.3L EFI T.C. vehicles code 27) present in continuous?	Yes ▶	REPLACE processor. RERUN Test Step **DP1**.
	No ▶	The original continuous code 29 or 27 was the result of the original VSS. SERVICE VSS as necessary.

Neutral Drive Switch A/C Input

Pinpoint Test

FA

TEST STEP	RESULT ▶	ACTION TO TAKE
FA1 CODE 67 SYSTEM IDENTIFICATION		
2.5L CFI M/T, 5.0L M/T TK		GO to **FA4**.
2.9L M/T TK, 3.0L M/T TK, 5.0L M/T SEFI		GO to **FA10**.
1.9L M/T, 2.3L EFI M/T Car and Truck, 2.3L CFI M/T		GO to **FA10**.
2.3L Turbo		GO to **FA15**.
2.3L Turbo Octane Switch		GO to **FA30**.
4.9L M/T, Truck		GO to **FA18**.
All other systems		GO to **FA2**.
FA2 NEUTRAL DRIVE INPUT CHECK		
 TEST PIN 10 A/C CLUTCH CIRCUIT AC NDS TEST PIN 30 NEUTRAL DRIVE CIRCUIT 1.9L ATX TEST PIN 46 SIGNAL RETURN A9652-A		
• Key Off, wait 10 seconds. • Verify heater control is in OFF position, if so equipped. • Verify transmission is in NEUTRAL or PARK. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box. • Processor connected. • Key On, Engine Off. • DVOM on 20V scale. • Measure voltage between test Pin 30 (Neutral Drive circuit) at the Breakout box and chassis ground. • Is reading less than 1.0 volt?	Yes ▶ No ▶	GO to **FA4**. GO to **FA3**.

Neutral Drive Switch A/C Input

Pinpoint Test

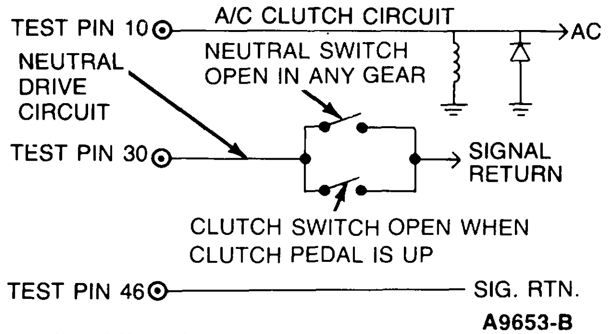
FA

TEST STEP	RESULT ▶	ACTION TO TAKE
FA3 NEUTRAL DRIVE SWITCH CHECK		
o Key Off, wait 10 seconds. o Breakout box installed. o DVOM on 200 ohm scale. o Locate the Neutral Drive switch. o Disconnect vehicle harness from the Neutral Drive switch and measure resistance across the switch. o Is resistance reading less than 5 ohms?	Yes ▶	SERVICE open in vehicle harness Neutral Drive circuit. RERUN Quick Test.
	No ▶	REPLACE Neutral Drive switch. RERUN Quick Test
FA4 A/C INPUT CHECK		
NOTE: Before entering this test, verify A/C is off. If A/C was on, rerun Quick Test. If code 67 or code 79 is present, continue with this test. o Breakout box installed. o Processor disconnected. o Key on, engine off. o DVOM on 20V scale. o Measure voltage between test Pin 10 at the Breakout box and chassis ground. o Is voltage reading 1.0 volt or greater?	Yes ▶	SERVICE short to power in A/C clutch circuit. RERUN Quick Test.
	No ▶	REPLACE processor. RERUN Quick Test.

Neutral Drive Switch A/C Input

Pinpoint Test

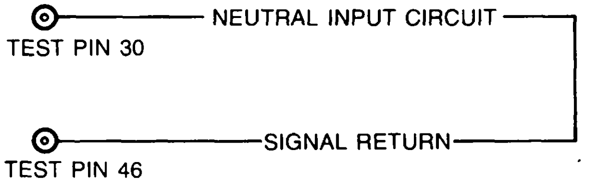
FA

TEST STEP	RESULT ▶	ACTION TO TAKE
FA10 NEUTRAL/CLUTCH INPUT CHECK		
 TEST PIN 10 A/C CLUTCH CIRCUIT AC NEUTRAL DRIVE CIRCUIT NEUTRAL SWITCH OPEN IN ANY GEAR TEST PIN 30 SIGNAL RETURN CLUTCH SWITCH OPEN WHEN CLUTCH PEDAL IS UP TEST PIN 46 SIG. RTN. A9653-B • Key Off, wait 10 seconds. • Verify A/C is off, if so equipped. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box. • Connect processor. • DVOM on 200 ohm scale. • Measure resistance between test Pin 30 and test Pin 46. 1. With transmission in NEUTRAL and clutch up. 2. With transmission in GEAR and clutch down. • Are both resistance readings less than 5 ohms?	Yes ▶ No ▶	GO to FA4. GO to FA11.
FA11 NEUTRAL/CLUTCH SWITCH CHECK		
• Key Off. • DVOM on 200 ohm scale. • Breakout box installed. • Locate Neutral switch (on transmission) and Clutch switch (under dash). • Disconnect vehicle harness at both switches and inspect connectors for pushed back pins. • Measure resistance across the Neutral switch terminals with transmission in NEUTRAL and across the Clutch switch terminals with the clutch pedal down. • Are both resistance readings less than 5 ohms?	Yes ▶ No ▶	GO to FA12. REPLACE open switch(es). RECONNECT harness and RERUN Quick Test.

Neutral Drive Switch A/C Input

Pinpoint Test

FA

TEST STEP	RESULT ▶	ACTION TO TAKE
FA12 NEUTRAL/CLUTCH HARNESS CHECK		
o Key Off. o DVOM on 200 ohm scale. o Breakout box installed. o Vehicle harness disconnected at the Neutral switch and Clutch switch. o Measure resistance between test Pin 30 and the Neutral switch harness connector and between test Pin 30 and the Clutch switch harness connector. o Measure resistance between test Pin 46 and the Neutral switch harness connector and between test Pin 46 and the Clutch switch harness connector. o Are all resistance readings less then 5 ohms?	Yes ▶ No ▶	GO to FA4. SERVICE the harness/connector. RERUN Quick Test.
FA15 NEUTRAL INPUT CHECK — 2.3L TC M/T		
 NEUTRAL INPUT CIRCUIT TEST PIN 30 SIGNAL RETURN TEST PIN 46 A9654-A o Key Off, wait 10 seconds. o Verify A/C is off, if so equipped. o Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. o Install Breakout box. o Leave processor disconnected. o DVOM on 200 ohm scale. o Measure resistance between test Pin 30 (Neutral Input circuit) and test Pin 46 (Signal Return circuit) at the Breakout box. o Is resistance reading less than 5 ohms?	Yes ▶ No ▶	GO to FA4. SERVICE open in Neutral Input or Signal Return circuit. RERUN Quick Test.

Neutral Drive Switch A/C Input

Pinpoint Test

FA

TEST STEP	RESULT ▶	ACTION TO TAKE
FA18 CLUTCH PEDAL SWITCH CHECK 4.9L M/T		
NOTE: The clutch pedal must be down during KOEO test; if not, a code 67 will result. • Key Off. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box. • DVOM on 200 ohm scale. • Clutch pedal down. • Measure resistance between test Pin 30 and test Pin 46, between test Pin 30 and test Pin 40. • Is resistance reading less than 5 ohms?	Yes ▶ No ▶	REPAIR open in clutch circuit. GO to FA4.
FA20 A/C INPUT CIRCUIT CHECK		
NOTE: A low idle with A/C on could be the result of the processor not receiving, or recognizing the A/C input on Pin 10. • Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damage, corrosion or loose wires. Service as necessary. • Install Breakout box. • Leave processor disconnected. • DVOM on 20 volt scale. • Key On. • A/C on. • Check voltage between Pin 10 and Pin 40. • Is voltage reading greater than 10.5 volts?	Yes ▶ No ▶	REPLACE processor. RERUN Quick Test. SERVICE open in A/C circuit. Refer to the appropriate engine schematic in Section 17 or 18. RERUN Quick Test.

Neutral Drive Switch A/C Input

Pinpoint Test

FA

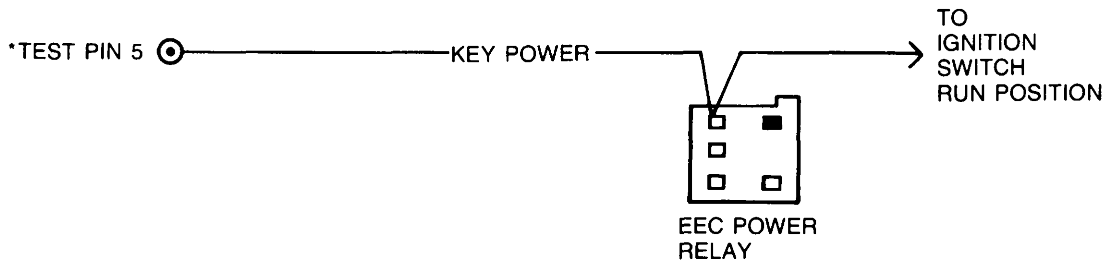
TEST STEP	RESULT ►	ACTION TO TAKE
FA30 CHECK OCTANE SWITCH INPUT FOR INPUT CHANGE		
○ Key Off, wait 10 seconds. ○ Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. ○ Install Breakout box. Reconnect processor. ○ DVOM to 20V scale. ○ Connect positive test lead to test Pin 30 and negative test lead to test Pin 46 at the Breakout box. ○ Key On, Engine Off. ○ Cycle octane switch several times while observing DVOM. ○ Does voltage change from zero volts to 5V?	Yes ►	REPLACE processor. RERUN Quick Test.
	No ►	EEC-IV system OK. REFER to Shop Manual for boost diagnostics.

Key Power Check

Pinpoint Test

FC

FC



*TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9656-A

STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 55 or 65 is received in Quick Test Step 3.0, 5.0 or 6.0.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Charging system overvoltage.
- Battery charger connected with engine running.
- Jump starting.

This Pinpoint Test is intended to diagnose only the following:

- Harness circuit: key power.
- Processor.

Key Power Check

Pinpoint Test

FC

TEST STEP	RESULT ▶	ACTION TO TAKE
FC1 BATTERY VOLTAGE GREATER THAN 17.5V		
⊙ Key Off, wait 10 seconds. ⊙ Install Breakout box with processor connected. ⊙ DVOM at 20V range and connected to test Pins 5 and 60 at the Breakout box. ⊙ Perform Engine Running Quick Test. Observe DVOM during test and record service codes.	Reading exceeds 17.5V during Quick Test ▶	CORRECT charging system for over-voltage condition.
	Reading remains below 17.5V and code 65 is present ▶	REPLACE processor and RERUN Quick Test.
	Reading remains below 17.5V and code 65 is not present ▶	GO to FC2.
FC2 CODE 65 IN CONTINUOUS MEMORY		
⊙ Perform Key On, Engine Off Quick Test and record continuous codes.	Code 65 not present ▶	TESTING complete. CHARGING system OK at this time.
	Code 65 present ▶	CHECK charging system, REFER to Shop Manual, Group 31 for cause of intermittent overcharging (greater than 17.5V).
FC3 BATTERY VOLTAGE LESS THAN 7.5V		
⊙ Key Off, wait 10 seconds. ⊙ Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. ⊙ Install Breakout box to processor harness connector. ⊙ Processor connected. ⊙ DVOM on 20V scale. ⊙ Measure voltage between test Pin 5 and test Pin 60 at the Breakout box. ⊙ Perform Engine Running Quick Test.	Voltage below 7.5V during Quick Test ▶	GO to FC4.
	Voltage remains above 7.5V and code 55 is present ▶	REPLACE processor. RERUN Quick Test.
	Voltage remains above 7.5V and code 55 is not present ▶	GO to FC5.

Key Power Check

Pinpoint Test

FC

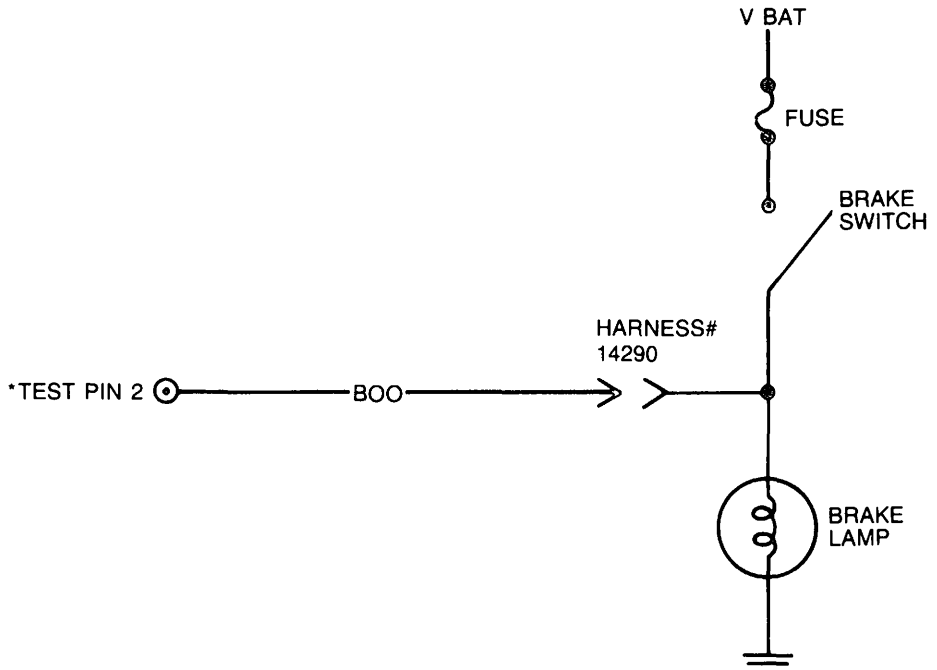
TEST STEP	RESULT ▶	ACTION TO TAKE
FC4 KEY POWER CIRCUIT CHECK		
• Key Off. • Breakout box installed, processor connected. • DVOM at 200 ohm scale. • Measure resistance between test Pin 5 at the Breakout box and key power terminal of EEC power relay.	5 ohms or less ▶	CORRECT charging system for under-voltage condition.
	Greater than 5 ohms ▶	SERVICE open in key power circuit. RERUN Quick Test.
FC5 CODE 55 IN CONTINUOUS MEMORY		
• Perform Key On, Engine Off Quick Test and record continuous codes.	Code 55 not present ▶	TESTING complete. CHARGING system OK at this time.
	Code 55 present ▶	CHECK charging system per Shop Manual, Group 31 for cause of intermittent overcharging (greater than 17.5V).

Brake On/Off (BOO)

Pinpoint Test

FD

FD



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9657-A

STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 74 or 75 is received in Quick Test Step 5.0.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Brake lamp, brake switch, and fuse.

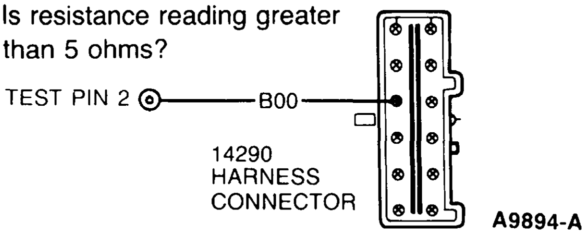
This pinpoint test is intended to diagnose only the following:

- BOO circuit.
- Processor assembly.

Brake On/Off (BOO) | Pinpoint Test | FD

TEST STEP	RESULT ▶	ACTION TO TAKE
FD1 SERVICE CODE 74		
• Did you press brake during the Engine Running Quick Test?	Yes ▶	GO to **FD2**.
NOTE: On some vehicles it is necessary to depress and release the brake after the dynamic response code 1(0) but before the brief WOT.	No ▶	RERUN Engine Running Quick Test, PRESS brake once during test.
FD2 BOO CIRCUIT CYCLING		
• Key Off, wait 10 seconds.	Yes ▶	REPLACE processor. RERUN Quick Test.
• Disconnect processor 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary.	No ▶	GO to **FD3**.
• Install Breakout box, leave processor disconnected.		
• DVOM on 20V scale.		
• Measure voltage between test Pin 2 and test Pin 40 at the Breakout box while depressing and releasing brake.		
• Does the voltage cycle?		
FD3 BOO CIRCUIT SHORT TO GROUND		
• Key Off.	Yes ▶	GO to **FD6**.
• Breakout box installed.		
• Processor disconnected.	No ▶	SERVICE BOO circuit short to ground. RERUN Engine Running Quick Test.
• DVOM on 200 Ohm scale.		
• Disconnect BOO circuit from 14290 harness (12 pin connector).		
• Measure resistance between test Pin 2 at the Breakout box and ground.		
• Is resistance reading greater than 5 ohms?		

Brake On/Off (BOO) | Pinpoint Test | FD

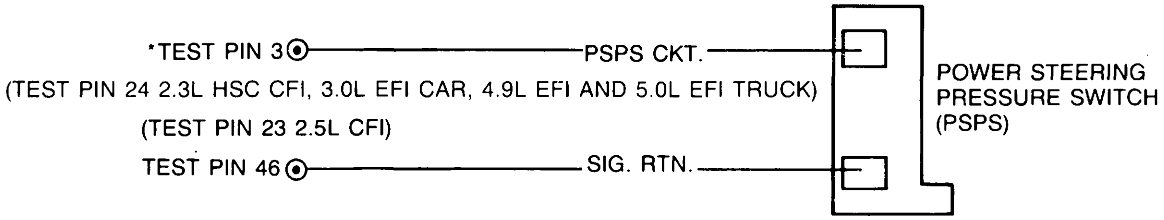
TEST STEP	RESULT ▶	ACTION TO TAKE
FD4 BOO CIRCUIT CYCLING CODE 75		
o Key Off, wait 10 seconds. o Disconnect processor 60 Pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. o Install Breakout box, leave processor disconnected. o DVOM on 20V scale. o Measure voltage between test Pin 2 and test Pin 40 at the Breakout box while depressing and releasing brake. o Does the voltage cycle?	Yes ▶ No ▶	REPLACE processor. RERUN Quick Test. GO to FD5.
FD5 BOO CIRCUIT SHORT TO POWER		
o Key Off. o Breakout box installed. o Processor disconnected. o DVOM on 20V scale. o Disconnect BOO circuit from 14290 harness (12 Pin connector). o Measure voltage between test Pin 2 at the Breakout box and engine block ground. o Is voltage reading greater than 10.5 volts?	Yes ▶ No ▶	SERVICE BOO circuit short to power. BOO circuit OK. GO to Shop Manual, Group 32 to SERVICE stoplamp circuit.
FD6 BOO HARNESS CONTINUITY CHECK		
o Key Off. o Breakout box installed. o Processor disconnected. o DVOM on 200 Ohm scale. o Disconnect BOO circuit from 14290 harness (12 pin connector). o Measure resistance between test Pin 2 at the Breakout box and BOO circuit at the 14290 harness connector. o Is resistance reading greater than 5 ohms?  	Yes ▶ No ▶	SERVICE BOO circuit for open. RERUN Engine Running Self Test. GO to Shop Manual, Group 32.

Power Steering Pressure Switch (PSPS)

Pinpoint Test

FF

FF


*TEST PIN 3
PSPS CKT.
(TEST PIN 24 2.3L HSC CFI, 3.0L EFI CAR, 4.9L EFI AND 5.0L EFI TRUCK)
(TEST PIN 23 2.5L CFI)
TEST PIN 46
SIG. RTN.
POWER STEERING PRESSURE SWITCH (PSPS)

***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9658-B

STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 52 is received in Quick Test Steps 3.0, 5.0 or if you are directed here from Diagnostics by Symptom in the Engine Supplement Section.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Idle speeds/throttle stop adjustment.
- Binding throttle shaft/linkage or speed control linkage.

This Pinpoint Test is intended to diagnose only the following:

- Power steering pressure switch.
- Switch harness circuits: PSPS Signal, and Signal Return.
- Processor assembly.

Power Steering Pressure Switch (PSPS) | Pinpoint Test | FF

TEST STEP	RESULT ▶	ACTION TO TAKE
FF1 ATTEMPT TO ELIMINATE CODE 52		
○ Key Off, wait 10 seconds. ○ Disconnect PSPS. ○ Jumper PSPS circuit to Signal Return at vehicle harness connector. ○ Rerun Key On, Engine Off Quick Test. ○ Is code 52 still present?	Yes ▶	GO to **FF2**.
	No ▶	REPLACE PSPS. RERUN Quick Test.
FF2 PSPS HARNESS CHECK		
○ Key Off, wait 10 seconds. ○ Disconnect harness from processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. ○ PSPS disconnected. ○ Processor disconnected. ○ Breakout box installed. ○ DVOM on 200 ohm scale. ○ Measure resistance between test Pin 46 at the Breakout box and Signal Return at the PSPS connector and between test Pin 3 (2.3L OHC EFI), test Pin 23 (2.5L CFI), test Pin 24 (2.3L HSC, 3.0L EFI, 4.9L EFI and 5.0L EFI) at the Breakout box and PSPS circuit at the PSPS harness connector. ○ Are both readings less than 5 ohms?	Yes ▶	REPLACE processor. RERUN Quick Test.
	No ▶	SERVICE open in circuit. RERUN Quick Test.
FF3 SWITCH INTEGRITY		
○ Install tachometer. ○ Start engine, allow to idle in Neutral/Park. ○ Disconnect PSPS at switch. ○ Does rpm increase?	Yes ▶	REPLACE PSPS.
	No ▶	GO to **FF4**.

Power Steering Pressure Switch (PSPS)

Pinpoint Test

FF

TEST STEP	RESULT ▶	ACTION TO TAKE
FF4 PSPS HARNESS CHECK		
• Key Off, wait 10 seconds. • Disconnect harness from processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • PSPS disconnected. • Processor disconnected. • Breakout box installed. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 3 (2.3L OHC EFI), test Pin 23 (2.5L CFI), test Pin 24 (2.3L HSC CFI, 3.0L EFI, 4.9L EFI and 5.0L EFI) and test Pin 46 at the Breakout box. • Is reading less than 10,000 ohms?	Yes ▶ No ▶	SERVICE short in harness. REPLACE processor.
FF5 SERVICE CODE 52 ENGINE RUNNING SELF-TEST		
• Did you turn the steering wheel one-half turn any time after engine ID code, but before the dynamic response code? **NOTE: Make sure the front wheels are centered (no load condition).**	Yes ▶ No ▶	GO to **FF6**. RERUN Quick Test.
FF6 DETERMINE WHETHER THE PROCESS CAN IDENTIFY AN OPEN CIRCUIT		
• Key Off, wait 10 seconds. • Disconnect PSPS. • Run Key On Engine Off Self-Test. • Is code 52 present?	Yes ▶ No ▶	GO to **FF8**. GO to **FF7**.
FF7 PSPS HARNESS CHECK		
• Key Off, wait 10 seconds. • Disconnect harness from processor 60 Pin connector and inspect for damaged pins, corrosion or loose wires. Service as necessary. • PSPS disconnected. • Processor disconnected. • Breakout box installed. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 46 and test Pin 24 at the Breakout box. • Is resistance reading 10,000 ohms or less?	Yes ▶ No ▶	SERVICE PSPS circuit short to signal return. RERUN Quick Test. REPLACE processor. RERUN Quick Test.

Power Steering Pressure Switch (PSPS) | Pinpoint Test | FF

TEST STEP		RESULT ▶	ACTION TO TAKE
FF8	PSPS POSITION KEY ON ENGINE NOT RUNNING VS. RUNNING		
	⊙ Key Off, wait 10 seconds. ⊙ Breakout box installed. ⊙ Processor connected. ⊙ PSPS connected. ⊙ DVOM on 200 ohm scale. ⊙ Key On. ⊙ Measure resistance from test Pin 24 to test Pin 46. ⊙ Start engine. ⊙ Does resistance remain less than 10 ohms between Key On Engine Off and Engine Running?	Yes ▶ No ▶	GO to **FF9**. GO to **FF11**.
FF9	PSPS POSITION ENGINE RUNNING NO LOAD VS. LOAD		
	⊙ Breakout box installed. ⊙ Processor connected. ⊙ PSPS connected. ⊙ DVOM on 200 ohm scale. ⊙ Engine idling. ⊙ Measure the resistance from test Pin 24 to test Pin 46. ⊙ Turn the steering wheel at least one-half turn then return. ⊙ Does resistance change from less than 10 ohms to infinity (indicating PSPS opening), then returning to 10 ohms or less when steering wheel is returned to center position?	Yes ▶ No ▶	PSPS system OK, REMOVE Breakout box and RETURN to Quick Test Step 5.0 to continue Diagnostics. GO to **FF10**.

Power Steering Pressure Switch (PSPS)

Pinpoint Test

FF

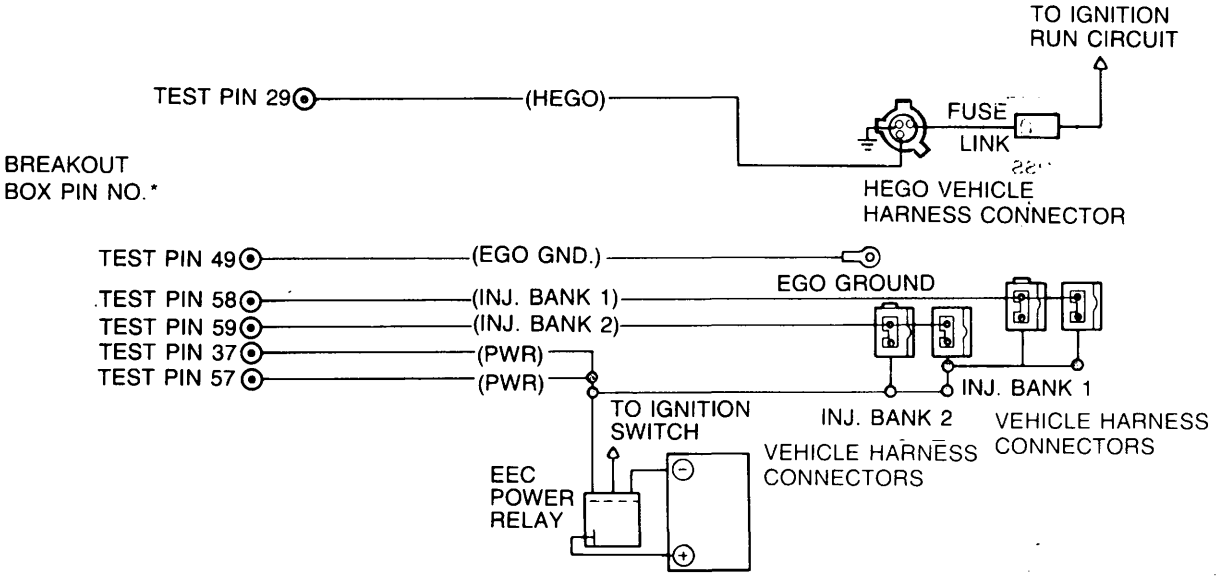
TEST STEP		RESULT ▶	ACTION TO TAKE
FF10	PSPS VS. POWER STEERING HYDRAULIC PRESSURE (ENGINE RUNNING ALWAYS CLOSED)		
	• At this point in the Diagnostics there are only two possible causes for the original code 52 Engine Running: — PSPS (switch) that will not open. — Low available hydraulic pressure. • Key Off, wait 10 seconds. • Substitute original PSPS with a known good PSPS. • Run Engine Running Self Test. (Turn steering wheel one-half turn during test.) • Is code 52 still present?	Yes ▶	GO to Power Steering Pressure Diagnostics, Shop Manual, Group 13, looking for low pressure.
		No ▶	Original code 52 Engine Running was a result of a bad PSPS (switch). REMOVE all equipment and continue, if necessary, with any other Diagnostics.
FF11	PSPS VS. POWER STEERING HYDRAULIC PRESSURE (ENGINE RUNNING ALWAYS OPEN)		
	• At this point in the Diagnostics there are two possible causes for the original code 52 Engine Running: — PSPS (switch) that always remains open during Engine Running. — Excessively high hydraulic pressure. • Key Off, wait 10 seconds. • Substitute original PSPS with a known good PSPS. • Run Engine Running Self Test. (Turn steering wheel one-half turn during test.) • Is code 52 still present?	Yes ▶	GO to Power Steering Pressure Diagnostics in Shop Manual, Group 13, looking for high pressure.
		No ▶	Original code 52 Engine Running was a result of a bad PSPS (switch). REMOVE all equipment and continue, if necessary, with any other Diagnostics.

Fuel Control — 1.9L EFI and 2.3L EFI TC

Pinpoint Test

HA

HA



***TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.**

A9659-B

STOP-WARNING

You should enter this Pinpoint Test Only when a Service Code 41, 42 or 43 is received in Quick Test Step 5.0 or 6.0 or when directed here from Pinpoint Test A or Diagnostics by Symptom in the Engine Supplement Section.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Ignition Coil
- Distributor Cap
- Distributor Rotor
- Fouled Spark Plugs
- Spark Plug Wires
- CANP Problems
- PCV Valves (see note below)
- EGR Valve and Gasket
- Air Filter
- Fuel Contamination, Engine Oil
- Poor Power Ground
- Fuel Pressure
- Manifold Leaks, Intake/Exhaust
- Engine Not at Normal Operating Temperatures

This Pinpoint Test is intended to diagnose only the following:

- HEGO Sensor
- Harness Circuits HEGO Grd., HEGO, INJ BANK 1, INJ BANK 2, V PWR
- HEGO Sensor Connection
  - Code 42 start at HA8
  - Code 41 start HA14
  - Code 43 start at HA30
- Vacuum Systems
- Fuel Injectors
- Processor Assembly

NOTE: Fuel contaminated engine oil may affect 41, 42 Service Codes. If this is suspected, remove the PCV from the valve cover and repeat the Quick Test. If the problem is corrected, then change the engine oil and filter.

Fuel Control — 1.9L EFI and 2.3L EFI TC

Pinpoint Test

HA

TEST STEP	RESULT ▶	ACTION TO TAKE
HA1 FUEL PRESSURE CHECK 1		
• Key Off, wait 10 seconds. • Install fuel pressure gauge. • Start and run engine. Is fuel pressure between 35 and 45 psi (241-310 kPa)? **For No Starts:** • If engine will not run, cycle the key from Off to On several times to increase fuel pressure.	Yes ▶ No ▶	GO to HA2. REFER to the Shop Manual Group 24 for electric fuel pump and Section 11 for fuel pressure regulator check.
HA2 FUEL PRESSURE CHECK 2		
• Does fuel pressure remain between 35 and 45 psi (241-310 kPa) for 60 seconds or longer after final Key Off?	Yes ▶ No ▶	GO to HA3. GO to HA7.
HA3 FUEL DELIVERY TEST		
• Key Off. • Fuel pressure gauge installed. • Pressurize fuel system as per Step HA1. • Locate and disconnect the fuel pump relay. • Crank engine for 5 seconds. • Take pressure reading at the end of 5 second crank. • Is pressure between 10 and 20 psi?	Yes ▶ No ▶	The EEC system is not the fault of the No Start. Fuel and spark are present. REFER to Section 2 for other No Start Routines. If complaint was runs rough/ misses or fuel code GO to HA4. GO to HA4.

NOTE: The colder the engine, the greater the pressure drop (i.e., an engine coolant temperature of 200°F equals approximately a 10 psi drop in 5 seconds. 60°F equals approximately a 20 psi drop in 5 seconds).

Verify fuel quality; air and/or water will also pressurize and look like acceptable fuel delivery.

Fuel Control — 1.9L EFI and 2.3L EFI TC

Pinpoint Test

HA

TEST STEP	RESULT ▶	ACTION TO TAKE
HA4 INJECTOR HARNESS RESISTANCE CHECK		
o Key Off, wait 10 seconds. o Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. o Connect Breakout box to harness. Leave processor disconnected. o DVOM on 200 ohm scale. o Measure the resistance of injector Bank 1 between test Pin 37 and test Pin 58 at the Breakout box. Record resistance. o Measure the resistance of injector Bank 2 between test Pin 37 and test Pin 59 at the Breakout box. Record resistance. o Are both resistances between 1.2 ohms and 1.8 ohms?	Yes ▶ No ▶	GO to **HA6**. GO to **HA5**.
HA5 ISOLATE FAULTY INJECTOR CIRCUIT		
o Key Off. o Breakout box installed. o Leave processor disconnected. o DVOM on 200 ohm scale. o Disconnect all injectors on suspect Bank. Measure resistance of each injector by connecting one injector at a time, and reading the resistance between test Pins 37 and 58 at the Breakout box for Bank 1 or test Pins 37 and 59 at the Breakout box for Bank 2. o Are all resistances between 2.0 and 2.7 ohms?	Yes ▶ No ▶	GO to **HA6**. SERVICE the harness/connectors on the suspect injector for opens or shorts. If OK, REPLACE injector. RERUN Quick Test.

Fuel Control — 1.9L EFI and 2.3L EFI TC

Pinpoint Test

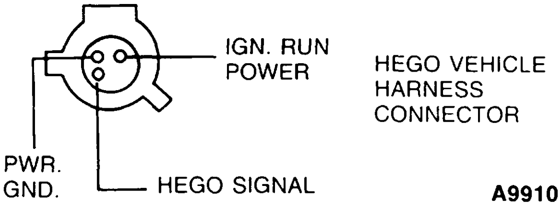
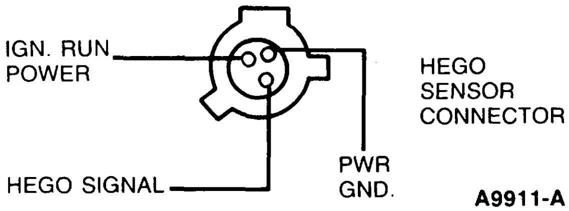
HA

TEST STEP	RESULT ▶	ACTION TO TAKE
HA6 INJECTOR DRIVE SIGNAL CHECK		
Requires standard non-powered 12 volt test lamp. • Key Off. • Breakout box installed. • Connect processor to Breakout box. • Connect test lamp between test Pin 37 and test Pin 58 at the Breakout box. • Crank or start engine. • Repeat above test between test Pin 37 and test Pin 59 at the Breakout box.	Dim glow at light on both tests ▶	GO to HA7.
	No light on one or both tests ▶	VERIFY 12-volt battery power at Pins 37 and 57. If OK, REPLACE processor. RERUN Quick Test.
	Bright light on one or both tests ▶	CHECK circuits Bank 1 and Bank 2 for shorts to ground. If OK, REPLACE processor. RERUN Quick Test.
HA7 INJECTOR BALANCE TEST		
• Connect tachometer to engine. Disconnect ISC. Run engine at 2000 rpm. Use throttle body stop screw to set engine speed. • Disconnect and reconnect the injectors one at a time; note rpm drop for each injector. • Does each injector produce at least a 150 rpm drop? • Reconnect ISC. Reset curb idle. Refer to VECI decal and Section 4.	Yes ▶	Fuel delivery OK. Problem is with area common to all cylinders, i.e.: Air/vacuum leak, fuel contamination, EGR.
	No ▶	REPLACE faulty injector. RERUN Quick Test.

Fuel Control — 1.9L EFI and 2.3L EFI TC

Pinpoint Test

HA

TEST STEP	RESULT ▶	ACTION TO TAKE
HA8 FUEL CONTROL — ALWAYS RICH: CODE 42. CHECK HEGO HARNESS FOR SHORT TO POWER		
- Key Off, wait 10 seconds. - Disconnect the HEGO sensor from the vehicle harness. - DVOM on 20 volt scale. - Key On. - Measure voltage between HEGO signal and ground at the HEGO harness connector. - Is voltage less than .5 volt?  IGN. RUN POWER HEGO VEHICLE HARNESS CONNECTOR PWR. GND. HEGO SIGNAL A9910-A	Yes ▶ No ▶	GO to HA9. SERVICE short to power in HEGO signal circuit. RERUN Quick Test.
HA9 CHECK HEGO FOR SHORT TO KEY POWER		
- Key Off. - HEGO disconnected. - DVOM on 200,000 ohm scale. - Measure resistance between Key Power input and HEGO signal at the HEGO. - Is resistance greater than 10,000 ohms?  IGN. RUN POWER HEGO SENSOR CONNECTOR HEGO SIGNAL PWR GND. A9911-A	Yes ▶ No ▶	GO to HA10. REPLACE HEGO sensor. RERUN Quick Test.

Fuel Control — 1.9L EFI and 2.3L EFI TC

Pinpoint Test

HA

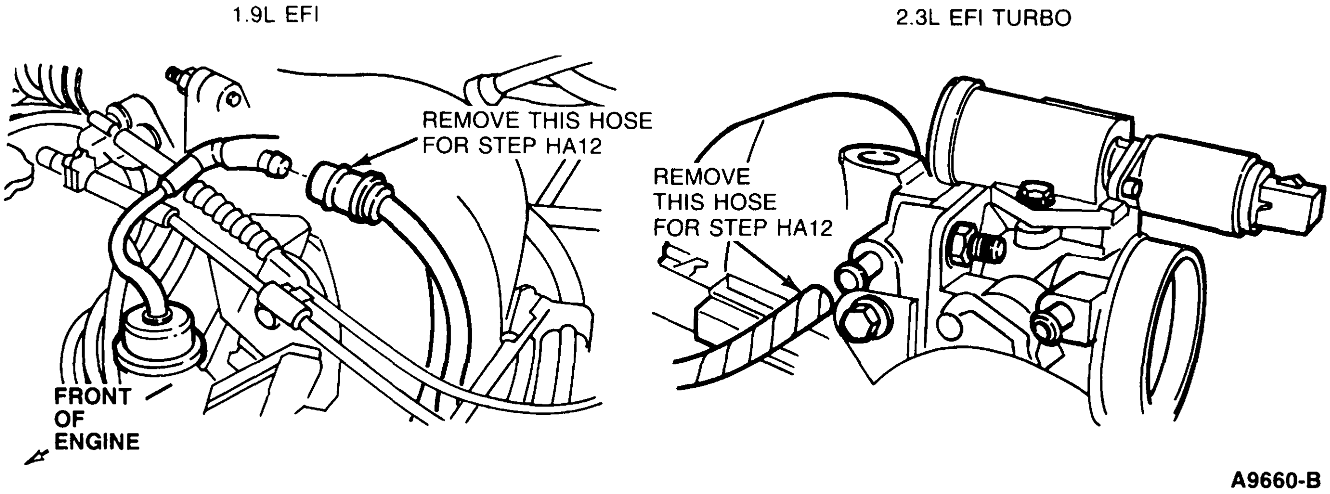
TEST STEP	RESULT ▶	ACTION TO TAKE
HA10 ATTEMPT TO GENERATE CODE 41		
• Key Off, wait 10 seconds. • **NOTE: Non-EEC areas could cause a code 42. Check for:** **— Fuel contaminated engine oil** **— Ignition caused misfire** **— CANP problems** • Disconnect vehicle harness at the HEGO sensor. Ground the HEGO circuit at the HEGO vehicle harness connector to the engine block. • Repeat Engine Running Self-Test. • Is service code 41 present?	Yes ▶ No ▶	GO to HA12. GO to HA11.
HA11 HARNESS CHECK		
• Key Off, wait 10 seconds. • Install Breakout box. • Measure resistance of HEGO ground circuit between test Pin 49 at the Breakout box and HEGO ground at engine block. • Measure resistance of HEGO circuit between test Pin 29 at the Breakout box and HEGO harness connector. • Are both circuits less than 5 ohms?	Yes ▶ No ▶	DISCONNECT processor connector. INSPECT for damage or corrosion. If OK, REPLACE processor. RERUN Quick Test. CORRECT harness circuit with resistance greater than 5 ohms. RERUN Quick Test.

Fuel Control — 1.9L EFI and 2.3L EFI TC

Pinpoint Test

HA

TEST STEP	RESULT	ACTION TO TAKE
HA12 EGO CHECK		
- DVOM on 20V scale. - With HEGO sensor disconnected from the vehicle harness, connect a DVOM from HEGO sensor to engine ground. - Run the engine at 2000 rpm for 1 minute. While observing DVOM, disconnect the manifold vacuum hose indicated below. - Is voltage less than 0.4V?	Yes ▶ No ▶	HEGO sensor OK. GO to HA1. REPLACE HEGO sensor. RERUN Quick Test.

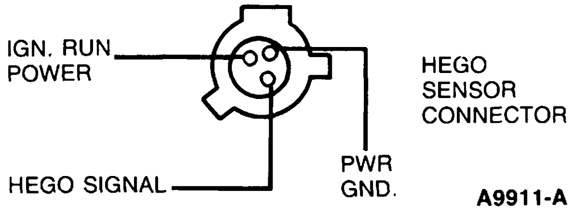

1.9L EFI
REMOVE THIS HOSE FOR STEP HA12
FRONT OF ENGINE
2.3L EFI TURBO
REMOVE THIS HOSE FOR STEP HA12
A9660-B

TEST STEP	RESULT	ACTION TO TAKE
HA13 FUEL CONTROL — ALWAYS LEAN: CODE 41 VERIFICATION		
- Run vehicle at 2000 rpm for two minutes. - Key Off, wait 10 seconds. - Perform Engine Running Self-Test. - Is code 41 present?	Yes ▶ No ▶	GO to HA14. GO to HA20.

Fuel Control — 1.9L EFI and 2.3L EFI TC

Pinpoint Test

HA

TEST STEP	RESULT ▶	ACTION TO TAKE
HA14 FUEL CONTROL — ALWAYS LEAN: CODE 41		
NOTE: Vacuum/air leaks in non-EEC areas could cause a code 41. Check for: **— Leaking vacuum actuator (eg: A/C control motor)** **— Engine sealing** **— EGR system** **— PCV system** **— Unmetered air leak between air meter and throttle body** **— Lead contaminated HEGO sensor** • Key Off. DVOM on 20V scale. Disconnect HEGO sensor from vehicle harness. Connect DVOM between HEGO signal at HEGO sensor and engine ground. Remove air cleaner to gain access to air meter inlet. Using a standard wood lead pencil, prop the air meter door part-way open. • Start the engine and run at approximately 2000 rpm for 2 minutes. • Does the DVOM read greater than 0.5V at the end of 1 minute?  IGN. RUN POWER HEGO SENSOR CONNECTOR HEGO SIGNAL PWR GND. A9911-A	Yes ▶ No ▶	GO to HA15. REPLACE HEGO sensor. RERUN Quick Test.
HA15 HARNESS CHECK EGO CIRCUITS		
• Key Off. • Install Breakout box. Processor disconnected. • Measure resistance of HEGO circuit between test Pin 49 at the Breakout box and engine block ground. Also HEGO circuit between HEGO connector and test Pin 29 at the Breakout box. • Are both circuits less than 5 ohms?	Yes ▶ No ▶	GO to HA16. SERVICE/CORRECT as necessary any circuit greater than 5 ohms. RERUN Quick Test.

Fuel Control — 1.9L EFI and 2.3L EFI TC

Pinpoint Test

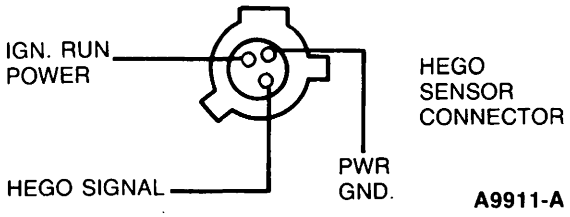
HA

TEST STEP	RESULT ▶	ACTION TO TAKE
HA16 CHECK HEGO CIRCUIT FOR SHORT TO GROUND		
o Key Off. o Breakout box installed. Processor disconnected. o DVOM to 200,000 ohms scale. o Measure the resistance between test Pin 29 and test Pin 40 at the Breakout box. o Is resistance greater than 10,000 ohms?	Yes ▶ No ▶	GO to HA17. CORRECT cause of resistance to ground. RERUN Quick Test.
HA17 CHECK HEGO SENSOR FOR SHORT TO GROUND		
o Key Off. o HEGO disconnected. o DVOM on 200,000 ohm scale. o Measure resistance between ground and HEGO signal at HEGO sensor. o Is resistance greater than 10,000 ohms?	Yes ▶ No ▶	GO to HA18. REPLACE HEGO sensor. RERUN Quick Test.
HA18 ATTEMPT TO ELIMINATE CODE 41		
o Key Off. o Reconnect HEGO sensor. Remove air cleaner to gain access to air meter inlet. Using a standard wood lead pencil, prop the air meter door part-way open. o Start the engine and run at approximately 2000 rpm for 2 minutes. o Perform Engine Running Self-Test. o Is code 41 present?	Yes ▶ No ▶	INSPECT for corrosion or damaged pins. If OK, REPLACE processor. RERUN Quick Test. HEGO input circuit OK. GO to HA1.

Fuel Control — 1.9L EFI and 2.3L EFI TC

Pinpoint Test

HA

TEST STEP		RESULT ▶	ACTION TO TAKE
HA20	CHECK HEATER ELEMENT RESISTANCE ON HEGO		
	• Key Off. • DVOM on 200 ohm scale. • HEGO disconnected. • Measure resistance between ignition run circuit and power ground at HEGO sensor. • Hot to warm resistance specification is 5 to 20 ohms. • Is resistance within specification? **NOTE: Room temperature resistance specification is 2 to 5 ohms.**  IGN. RUN POWER HEGO SENSOR CONNECTOR PWR GND. HEGO SIGNAL A9911-A	Yes ▶ No ▶	GO to **HA21**. REPLACE HEGO sensor.
HA21	CHECK FOR POWER AT HEGO HARNESS CONNECTOR		
	• Key On Engine Off. • DVOM on 20V scale. • Measure voltage between ignition run power and power ground at HEGO vehicle harness. • Is voltage greater than 10.5 volts?	Yes ▶ No ▶	HEGO sensor system OK. RECONNECT HEGO and GO to **HA14**. GO to **HA22**.
HA22	CHECK CONTINUITY OF GROUND TO HEGO CONNECTOR		
	• Key Off, wait 10 seconds. • DVOM on 200 ohm scale. • Measure resistance between battery ground and HEGO ground at HEGO vehicle harness. • Is resistance 5.0 ohms or less?	Yes ▶ No ▶	SERVICE open in ignition run power circuit. SERVICE open in ground circuit.

Fuel Control — 1.9L EFI and 2.3L EFI TC

Pinpoint Test

HA

HA30 CONTINUOUS TESTING: CODE 41, 42 OR 43

41 — HEGO indicated the fuel system was lean for more than 15 seconds when the system should have been in closed loop fuel control.

42 — HEGO indicated the fuel system was rich for more than 15 seconds when the system should have been in closed loop fuel control.

43 — HEGO indicated the fuel system was lean at WOT for more than 3 seconds.

CLOSED LOOP — Fuel control under the influence of the HEGO sensor.

OPEN LOOP — Fuel control NOT under the influence of the HEGO sensor.

Before attempting to correct a continuous fuel control code 41, 42 or 43, diagnose all other drive complaints first, eg., rough idle, misses, etc.

NOTE: The fuel control code may help in this diagnosis.

Using the fuel control service code, isolate the cause of the fuel control problem.

Some areas to check are:

o Unmetered Air:	Vacuum leaks/intake air leaks. — Canister Purge System. — PCV System. — Engine sealing. — Air leaks between VAF meter and throttle body. — Crimped fuel line. — Plugged fuel filter. — Fouled injectors.
o HEGO Fuel Fouled:	Whenever an over-rich fuel condition has been experienced (fuel fouled spark plugs), make a thorough check of the ignition system. In the event the HEGO sensor is suspected of being fuel fouled (low output, slow response), run the vehicle at sustained high speeds (within legal limits) followed by a few hard accelerations. This will burn off HEGO contamination and restore proper HEGO operation.
o Fuel Pressure:	Perform Pinpoint Test Step HA1.
o Ignition System:	Always in default spark (10 degrees). Refer to Quick Test Step 4.0.
o Improper Fueling:	Lead fouled HEGO sensor.
o TP Sensor:	Not moving (mechanical damage). Connect DVOM to test Pin 47 and to test Pin 46. Key to Run. Observe DVOM while moving the throttle. Reading must increase with increase in throttle opening. If not correct, REPLACE as necessary.

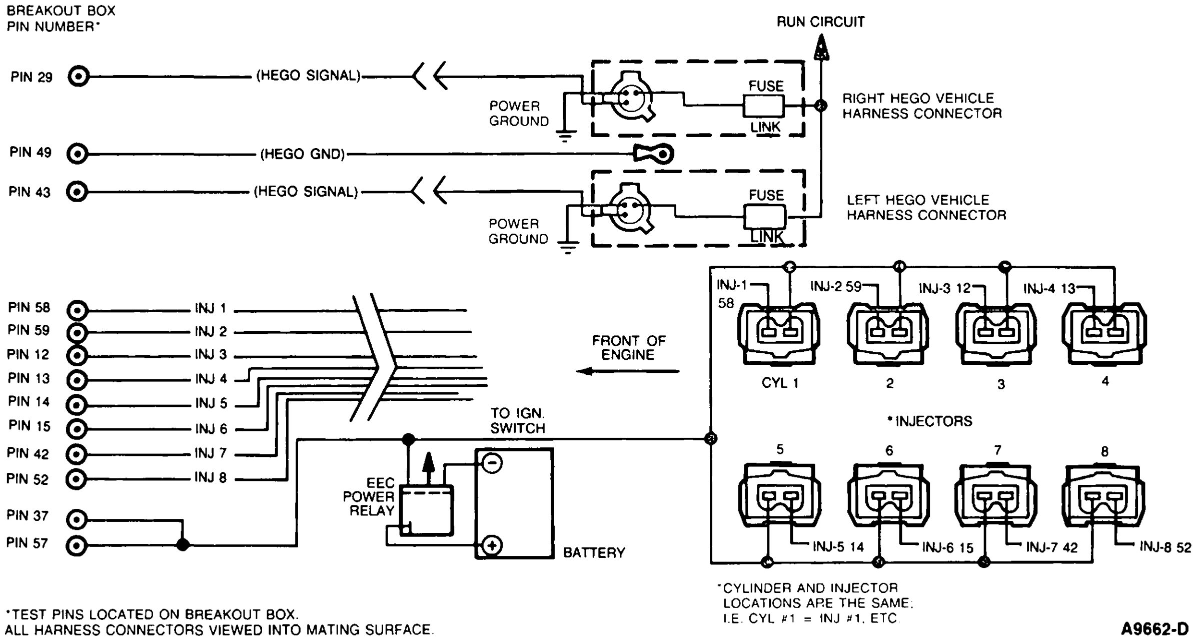
o If at this point, the drive concern is still present, perform Steps HA3 through HA6 only.

Fuel Control — 5.0L SEFI

Pinpoint Test

HC

HC



*TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

*CYLINDER AND INJECTOR LOCATIONS ARE THE SAME. I.E. CYL #1 = INJ #1, ETC

A9662-D

STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 41, 91 or 42, 92 is received in Quick Test Step 5.0 or 6.0 or when directed here from Pinpoint Test S.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Ignition Coil
- Distributor Cap
- Distributor Rotor
- Fouled Spark Plugs
- Spark Plug Wires
- CANP Problems
- PCV Valves (see note below)
- Compression Level
- Valve Problem
- EGR Valve and Gasket
- Air Filter
- Fuel Contamination, Engine Oil
- Poor Power Ground
- Fuel Pressure
- Manifold Leaks, Intake/Exhaust
- Engine Not at Normal Operating Temperatures
- Cracked Piston

This Pinpoint Test is intended to diagnose only the following:

- HEGO Sensor
- HEGO Sensor Connection
- Vacuum Systems
- Fuel Injectors
- Processor Assembly
- Harness Circuits: HEGO GRD, HEGO, INJ 1-8 and VPWR

NOTE: Fuel-contaminated engine oil may affect 41, 91 and 42, 92 Service Codes, so if it is suspected, remove the PCV from the valve cover, and rerun the Quick Test. If the problem is corrected, then change the engine oil and filter.

Fuel Control — 5.0L SEFI

Pinpoint Test

HC

TEST STEP	RESULT ▷	ACTION TO TAKE
HC1 FUEL PRESSURE CHECK 1		
o Key Off, wait 10 seconds. o Install fuel pressure gauge. o Start and run engine. RUNNING FUEL PRESSURE SPECIFICATION 5.0L SEFI = 27-37 psi (186-254 kPa) o Is fuel pressure within specification? **For No Starts:** o If engine will not run, cycle the key from Off to On several times to increase fuel pressure. ENGINE OFF FUEL PRESSURE SPECIFICATION 5.0L SEFI = 35-45 psi (241-310 kPa)	Yes ▷	GO to HC2.
	No ▷	REFER to the Shop Manual, Group 24 for electric fuel pump and Section 11 for fuel pressure regulator check.
HC2 FUEL PRESSURE CHECK 2		
o Key On. o Does fuel pressure drop more than 5 psi within 60 seconds after Key Off?	Yes ▷	GO to HC4.
	No ▷	GO to HC3.
HC3 FUEL DELIVERY TEST		
o Key Off. o Fuel pressure gauge installed. o Pressurize fuel system as per Step HC1. o Locate and disconnect inertia switch (which disables fuel pump). o Crank engine for 5 seconds. o Take pressure reading at the end of 5 second crank. o Does pressure drop 5 psi or greater at end of 5 second crank cycle? **NOTE: Verify fuel quality; air and/or water will also pressurize and look like acceptable fuel delivery.**	Yes ▷	RECONNECT inertia switch. The EEC system is not the fault of the No Start. Fuel and spark are present. REFER to Section 2 for other No Start Routines. If complaint was runs rough, misses or fuel code, GO to HC4.
	No ▷	RECONNECT inertia switch. GO to HC7.

NOTE: The colder the engine, the greater the pressure drop (i.e., an engine coolant temperature of 200°F equals approximately a 10 psi drop in 5 seconds. 60°F equals approximately a 20 psi drop in 5 seconds).

Fuel Control — 5.0L SEFI

Pinpoint Test

HC

TEST STEP	RESULT ▶	ACTION TO TAKE
HC4 CYLINDER BALANCE TEST		
• Perform the Engine Running Self-Test. • After the last repeated code, wait 5-10 seconds. • "Goose" throttle very lightly (not wide-open throttle). • Time of test approximately 90 seconds. • Use table below to interpret codes. • Is service code 90 present? NOTE: • **See Appendix for cylinder balance test definition.** • **Mark VII/Lincoln Town Car calibration 8-22 has added Cylinder Balance Test capability.**	Yes ▶	Mark VII/Lincoln Town Car calibration 8-22, GO to HC5. ALL OTHERS, GO to Diagnostic By Symptom in the appropriate engine supplement section. Remember to use conventional diagnostic methods such as compression checks and scoping.
	No ▶	GO to HC6.

The cylinder balance test switches each injector "OFF" and "ON," one at a time. Service codes correspond to cylinder number, e.g., service code 30 indicates a problem with cylinder number 3. The cylinder balance test is designed to aid in the detection of a non-contributing cylinder. The Cylinder Balance Pinpoint Test Steps are designed to isolate only EEC related problems.

SERVICE CODE	90	10	20	30	40	50	60	70	80	77*
Cylinder/Injector Number	Pass	1	2	3	4	5	6	7	8	Rerun Test
Breakout Box Pin Number		58	59	12	13	14	15	42	52	

Fuel Control — 5.0L SEFI

Pinpoint Test

HC

TEST STEP	RESULT ▶	ACTION TO TAKE
HC5 PERFORM 2ND/3RD LEVEL CYLINDER BALANCE TEST		
NOTE: Mark VII/Lincoln Town Car calibration 8-22 only, a Cylinder Balance Test service code 90 received in the first test level indicates that the injector harness is not open or shorted and the processor is sending a drive signal to all injectors. The 2nd/3rd level Cylinder Balance Test is intended to aid in the detection of any partially contributing injectors. o Within 2 minutes after the previous Cylinder Balance Test, lightly depress and release throttle to enter 2nd or 3rd level Cylinder Balance Test. o Is service code 90 present for both levels? Refer to appendix for Cylinder Balance Test definition.	Yes ▶	GO to Diagnostic By Symptom in the appropriate engine supplement section. Remember to use conventional Diagnostic methods such as engine compression checks and scoping.
	No ▶	GO to HC8.
HC6 INJECTOR HARNESS SHORT CHECK		
o Key Off. o Disconnect processor 60 Pin connector and inspect for damaged Pins, corrosion, loose wires. Service as necessary. o Connect Breakout box to harness. Leave processor disconnected. o Suspect injector disconnected. o DVOM to 200,000 ohm scale. o Measure the resistance of the suspect injector circuit between the injector circuit test Pin at the Breakout box and test Pins 40 and 60 at the Breakout box. o Is resistance greater than 10,000 ohms?	Yes ▶	RECONNECT injector. GO to HC7.
	No ▶	Service short to ground. RECONNECT injector RERUN Quick Test and Cylinder Balance Test.

Fuel Control — 5.0L SEFI

Pinpoint Test

HC

TEST STEP	RESULT ▶	ACTION TO TAKE
HC7 INJECTOR DRIVER SIGNAL CHECK		
Requires standard non-powered 12-volt test lamp. • Key Off. • Breakout box installed. • Connect processor to Breakout box. • Connect test lamp between test Pin 37 and the suspect injector(s) circuit test Pin at the Breakout box. • Crank or start engine. • Is glow on light dim?	Yes ▶ No (Bright light or no light) ▶	GO to HC8. Replace processor. Rerun Quick Test and Cylinder Balance Test.
HC8 HARNESS AND INJECTOR RESISTANCE CHECK		
• Key Off, wait 10 seconds. • Breakout box installed. • Disconnect processor. • DVOM on 200 ohm scale. • Measure the resistance of the suspect injector circuit between the injector circuit test Pin at the Breakout box and test Pins 37 and 57 at the Breakout box. • Is resistance between 13.0 and 19.0 ohms? **For No Starts:** Pick any injector to read resistance.	Yes ▶ No ▶	CHECK for dirty/clogged injector(s), CLEAN as necessary. If OK, REPLACE injector. RERUN Quick-Test and Cylinder Balance Test. SERVICE the harness/connectors on the suspect injector for OPENS or cause of high resistance. If OK, replace the injector. RERUN Quick Test and Cylinder Balance Test. FOR NO STARTS: SERVICE harness for open in VPWR circuit. RERUN Quick Test.

Fuel Control — 5.0L SEFI

Pinpoint Test

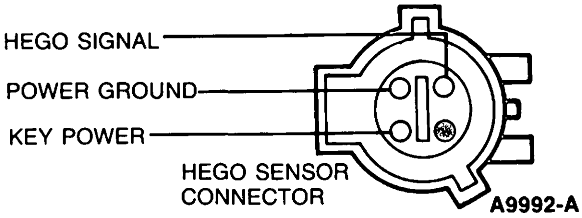
HC

TEST STEP		RESULT ▶	ACTION TO TAKE
HC9	FUEL CONTROL — ALWAYS LEAN: CODE 41, 91 VERIFICATION		
	• Run vehicle at 2000 rpm for two minutes. • Key Off, wait 10 seconds. • Perform Engine Running Self-Test. • Is code 41 or 91 present?	Yes ▶ No ▶	GO to HC10. GO to HC21.
HC10	FUEL CONTROL — ALWAYS LEAN: CODE 91 LEFT HEGO, OR 41 RIGHT HEGO		
	NOTE: Vacuum/air leaks in non-EEC areas could also cause code 41, or 91. Check for: — Leaking vacuum actuator (e.g.: A/C control motor) — Engine sealing — EGR system — PCV system — Unmetered air leak between air meter and throttle body — Lead contaminated HEGO sensor • Key Off. DVOM on 20V scale. Disconnect appropriate HEGO sensor from vehicle harness. Connect DVOM to HEGO sensor and engine ground. • Disconnect and plug vacuum line to MAP sensor. • Apply 14 in.-Hg. to MAP. • Start the engine. Does the DVOM read greater than 0.5V?	Yes ▶ No ▶	GO to HC11. REPLACE HEGO sensor. RECONNECT MAP vacuum line. RERUN Quick Test.
HC11	LEFT HEGO, OR RIGHT HEGO AND HEGO GROUND CONTINUITY CHECK		
	• Key Off. • Install Breakout box. Processor disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 49 at Breakout box and engine block ground. • Measure resistance between test Pin 29 at Breakout box and HEGO signal at vehicle harness connector and/or measure resistance between test Pin 43 at Breakout box and HEGO signal at vehicle harness connector. • Are all resistances less than 5 ohms?	Yes ▶ No ▶	GO to HC12. SERVICE open in appropriate circuit. RERUN Quick Test.

Fuel Control — 5.0L SEFI

Pinpoint Test

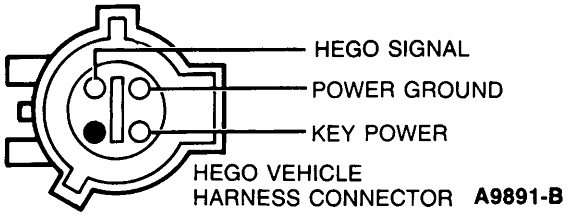
HC

TEST STEP	RESULT ▷	ACTION TO TAKE
HC12 HEGO CIRCUIT SHORT TO GROUND		
o Key Off, processor disconnected. o Disconnect appropriate HEGO. o DVOM on 200,000 ohm scale. o Measure resistance between test Pin 29 or test Pin 43 to test Pin 40 at the Breakout box. o Is resistance 10,000 ohms or less?	Yes ▷	CORRECT cause of resistance to ground. RERUN Quick Test.
	No ▷	GO to HC13.
HC13 CHECK HEGO SENSOR TO GROUND		
o Key Off. o HEGO disconnected. o DVOM on 200,000 ohm scale. o Measure resistance from HEGO power ground to HEGO signal at HEGO sensor. o Is resistance 10,000 ohms or less?  HEGO SIGNAL POWER GROUND KEY POWER HEGO SENSOR CONNECTOR A9992-A	Yes ▷	REPLACE HEGO sensor. RECONNECT MAP vacuum line. RERUN Quick Test.
	No ▷	GO to HC14.
HC14 ATTEMPT TO ELIMINATE CODE 41		
o Key Off. o Processor connected. o Reconnect HEGO sensor. o MAP vacuum line still disconnected and plugged. o Apply 10 in.-Hg. (33 kPa) vacuum to MAP sensor. o Start the engine and run at approximately 2000 rpm for one minute. Allow engine to return to idle. o Perform Engine Running Self-Test. o Is code 41 still present? **NOTE: Disregard any other code input at this time.**	Yes ▷	INSPECT for corrosion or damaged pins. If OK, REPLACE processor. RECONNECT MAP vacuum line. RERUN Quick Test.
	No ▷	RECONNECT MAP vacuum line. HEGO input circuit OK. GO to HC1 (Basic Fuel Delivery).

Fuel Control — 5.0L SEFI

Pinpoint Test

HC

TEST STEP	RESULT ▶	ACTION TO TAKE
HC15 CHECK HEGO HARNESS FOR SHORT TO POWER		
- Key Off, wait 10 seconds. - Disconnect appropriate HEGO for code 42 or 92. - DVOM on 20 volt scale. - Key On. - Measure voltage between HEGO signal and HEGO power ground at the HEGO harness connector.  HEGO SIGNAL POWER GROUND KEY POWER HEGO VEHICLE HARNESS CONNECTOR A9891-B - Is voltage less than 0.5 volts?	Yes ▶ No ▶	GO to HC16. REPAIR short to power in HEGO circuit. RERUN Quick Test.
HC16 CHECK HEGO SENSOR FOR SHORT TO KEY POWER		
- Key Off. - HEGO disconnected. - DVOM on 200,000 ohm scale. - Measure resistance from Key Power input to HEGO circuit at the HEGO sensor. - Is reading less than 10,000 ohms?	Yes ▶ No ▶	REPLACE HEGO sensor. RERUN Quick Test. GO to HC17.
HC17 ATTEMPT TO GENERATE CODE 41 or 91		
- Key Off, wait 10 seconds. **NOTE: Non-EEC areas could cause a code 42 or 92.** Check for: — Fuel contaminated engine oil. — Ignition caused misfire (fouled spark plug) — CANP problems - Refer to Illustration HC. - Disconnect vehicle harness at the appropriate HEGO sensor. Jumper (ground) the HEGO circuit at the HEGO sensor vehicle harness connector to the engine block. - Repeat Engine Running Self Test. - Is service code 41 or 91 present?	Yes ▶ No ▶	REMOVE jumper. GO to HC18. REMOVE jumper. DISCONNECT processor connector. INSPECT for damage or corrosion. If OK, REPLACE processor. RERUN Quick Test.

Fuel Control — 5.0L SEFI

Pinpoint Test

HC

TEST STEP	RESULT	ACTION TO TAKE
HC18 CHECK MAP SENSOR		
NOTE: **Due to the MAP sensor's large influence on fuel control, there is a possibility that a code 42 could be a result of a MAP problem, even though a code 22 is not present. Therefore the next two Pinpoint Tests Steps will verify proper vacuum to the MAP sensor and its ability to hold vacuum.**	Yes ▶	RELEASE vacuum. GO to HC19.
o Key Off, wait 10 seconds. o Disconnect vacuum line from MAP sensor. o Install vacuum pump to MAP sensor. o Apply 18 in.-Hg. (59 kPa) vacuum to MAP sensor. o Does MAP sensor hold vacuum?	No ▶	REPLACE MAP sensor. RECONNECT vacuum line to MAP sensor. RERUN Quick Test.
HC19 CHECK FOR LOSS OF MAP VACUUM		
o Tee a vacuum gauge in the intake manifold vacuum line at the MAP sensor. o Start engine and note vacuum reading. o Key Off, wait 10 seconds. o Remove vacuum gauge and tee and reconnect vacuum line to MAP.	Yes ▶	INSPECT vacuum lines for leaks, holes, disconnections, kinks, blockage and proper routing. SERVICE as necessary.
o Tee in vacuum gauge at a different source of intake manifold vacuum. o Start engine and note vacuum reading. o Do vacuum readings differ greater than 1 in.-Hg. (3.3 kPa)?	No ▶	GO to HC20.
HC20 HEGO CHECK		
o Refer to Illustration HC. o DVOM on 20 volt scale.	Yes ▶	HEGO sensor OK. GO to HC1.
o With HEGO sensor disconnected from the harness, connect a DVOM from HEGO sensor to engine ground. o Disconnect PCV hose. o Start engine and run at approximately 2000 rpm. Does the DVOM read less than 0.4 volts within 30 seconds?	No ▶	REPLACE HEGO sensor. RERUN Quick Test.

Fuel Control — 5.0L SEFI

Pinpoint Test

HC

TEST STEP	RESULT ▶	ACTION TO TAKE
HC21 CHECK HEATER ELEMENT RESISTANCE ON HEGO		
• Key off, engine off. • DVOM on 200 ohm scale. • HEGO disconnected. • Measure resistance between run circuit and ground at HEGO harness connector. — Refer to Pinpoint Test HC wiring schematic. • Hot to warm resistance specification is 5 to 20 ohms. **NOTE: At room temperature, resistance specification is 2 to 5 ohms.** • Is resistance within specification?	Yes ▶ No ▶	GO to HC22. REPLACE HEGO sensor.
HC22 CHECK FOR POWER AT HEGO HARNESS CONNECTOR		
• Key on, engine off. • DVOM on 20V scale. • Connect positive lead to run circuit and negative lead to ground at HEGO vehicle harness connector. • Is voltage greater than 10.5 volts?	Yes ▶ No ▶	HEGO's sensor system OK. RECONNECT HEGO and GO to HC2. GO to HC23.
HC23 CHECK CONTINUITY OF GROUND TO HEGO CONNECTOR		
• Key off, wait 10 seconds. • DVOM on 200 ohm scale. • Measure resistance of ground circuit from HEGO vehicle harness connector to battery ground. • Is resistance less than 5.0 ohms?	Yes ▶ No ▶	SERVICE open in run circuit. SERVICE open in ground circuit.

Fuel Control — 5.0L SEFI

Pinpoint Test

HC

HC90 CONTINUOUS TESTING: CODE 41 RIGHT HEGO/91 LEFT HEGO

CODE 41/91 — Indicates that a HEGO circuit has not switched during closed loop fuel control.

NOTE: In this situation, code 41/91 does not necessarily indicate a lean condition.

CLOSED LOOP —Fuel control under the influence of the HEGO sensors.

OPEN LOOP —Fuel control NOT under the influence of the HEGO sensors.

Before attempting to correct a continuous fuel control code 41/91, diagnose all other drive complaints first., eg., rough idle, misses, etc. in EEC Diagnostic By Symptom in the appropriate engine supplement.

NOTE: The fuel control code may help in this diagnosis.

Using the fuel control service code, isolate the cause of the fuel control problem.

Some areas to check are:

○ Vacuum Circuits:	Vacuum leaks/intake air leaks. —Canister Purge System. —PCV System. —Engine sealing.
○ HEGO Fuel Fouled:	Whenever an over-rich fuel condition has been experienced (fuel fouled spark plugs), make a thorough check of the ignition system. In the event a HEGO sensor is suspected of being fuel fouled (low output, slow response), run the vehicle at sustained high speeds (within legal limits) followed by a few hard accelerations. This will burn off HEGO contamination and restore proper HEGO operation.
○ Ignition System:	Always in default spark (10 degrees). Refer to Quick Test Step 4.0 .
○ Improper Fueling:	Lead fouled HEGO sensor.
○ Fuel Pressure:	Perform Pinpoint Test Step HC1 and HC2 .

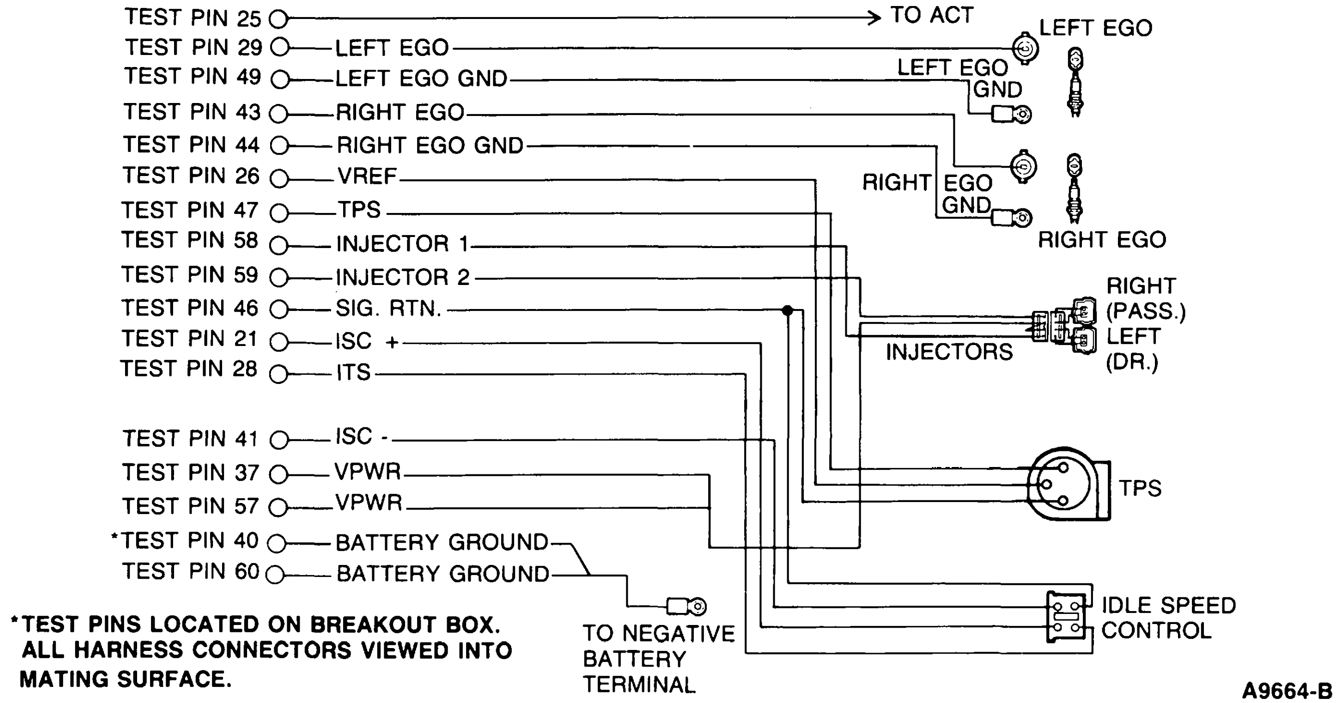
○ If at this point, the drive concern (if any) is still present, perform Steps HC4 through HC8 only.

Fuel Control — 3.8L CFI

Pinpoint Test

HD

HD REFERENCE DRAWING



***TEST PINS LOCATED ON BREAKOUT BOX. ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.**

STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 41, 91, 42 or 92 is received in Quick Test Step 5.0 or 6.0 or when directed here from Pinpoint Test A or by Diagnostics by Symptom in the Engine Supplement Section.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Ignition Coil
- Distributor Cap
- Distributor Rotor
- Fouled Spark Plugs
- Spark Plug Wires
- CANP Problems
- PCV Valves (see note below)
- EGR Valve and Gasket
- Air Filter
- Fuel Contamination, Engine Oil
- Poor Power Ground
- Fuel Pressure
- Manifold Leaks, Intake/Exhaust
- Engine Not at Normal Operating Temperatures

This Pinpoint Test is intended to diagnose only the following:

- EGO Sensors
- EGO Signals and Ground Circuits
- EGO Sensor Connections
- Fuel Injectors
- Processor Assembly

NOTE: Fuel-contaminated engine oil may affect 41, 91, 42 and 92 Service Codes, so if it is suspected, remove the PCV from the valve cover, and rerun the Quick Test. If the problem is corrected, then change the engine oil and filter.

Fuel Control — 3.8L CFI

Pinpoint Test HD

TEST STEP	RESULT ▶	ACTION TO TAKE
HD1 KEY POWER VOLTAGE CHECK		
• Key On. • Processor connected. • DVOM on 20V scale. • Measure voltage between test Pins 5 and 60 at the Breakout box.	Reading is less than 10.5V ▶	SERVICE open in key power circuit. RERUN Quick Test.
	Reading is 10.5V or greater ▶	GO to HD2.
HD2 FUEL PRESSURE CHECK		
• Install fuel pressure gauge. • Start and run engine. Fuel pressure must be 172-310 kPa (25-45 psi). • Fuel pressure must remain at 276 ± 34 kPa (40 psi ± 5 psi) for 60 seconds after final Key Off. **For No Starts:** • If engine will not run cycle the key from OFF to ON several times to increase fuel pressure.	Fuel pressure is within specifications ▶	GO to HD3.
	Fuel pressure is not 172-310 kPa (25-45 psi) ▶	REFER to Shop Manual, Group 24 for electric fuel pump.
	Fuel pressure does not remain at 276 ± 34 kPa (40 psi ± 5 psi) for 60 seconds or longer ▶	GO to HD6.
HD3 FUEL DELIVERY TEST		
• Key Off. • Fuel pressure gauge installed. • Pressurize fuel system as per Step HD2. • Locate and disconnect the fuel pump relay. • Crank engine for 5 seconds. • Take pressure reading at the end of 5-second crank. **NOTE: Verify fuel quality; air and/or water will also pressurize and look like acceptable fuel delivery.**	Pressure Gauge Reading: Pressure is approximately 10-20 psi at the end of 5-second crank cycle. Refer to Note below. ▶	The EEC system is not the fault of the No Start. Fuel and spark are present. REFER to Section 2 for other No Start Routines. If complaint was runs rough, misses or fuel code, GO to HD4.
	Pressure is greater or less than specified ▶	GO to HD4.

NOTE: The colder the engine, the greater the pressure drop (i.e., an engine coolant temperature of 200°F equals approximately a 10 psi drop in 5 seconds. 60°F equals approximately a 20 psi drop in 5 seconds).

Fuel Control — 3.8L CFI

Pinpoint Test

HD

TEST STEP	RESULT ▶	ACTION TO TAKE
HD4 HARNESS INJECTOR RESISTANCE CHECK		
○ Key Off. ○ DVOM on 200 ohm range. ○ Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. ○ Install Breakout box, processor disconnected. ○ Measure resistance between test Pins 57 and 58 at the Breakout box and between test Pins 57 and 59 at the Breakout box.	Either resistance is less than 1.5 ohms ▶	SERVICE the harness and/or connectors on the suspect injector for shorts. IF OK, REPLACE injector.
	Either resistance is greater than 3.5 ohms ▶	SERVICE the harness and/or connectors on the suspect injector for opens. If OK, REPLACE injector.
	Both resistances are 1.5-3.5 ohms ▶	GO to HD5.
HD5 INJECTOR DRIVE SIGNAL CHECK		
Requires standard non-powered 12V test lamp. ○ Key Off. ○ Breakout box installed. ○ Connect processor to Breakout box. ○ Refer to illustration HD. ○ Connect test lamp between test Pin 37 and Pin 58 at the Breakout box. ○ Crank or start engine. ○ Repeat above test between test Pin 37 and Pin 59 at the Breakout box.	Dim glow at light on both tests ▶	GO to HD6.
	No light on one or both tests ▶	VERIFY 12V battery power at Pins 37 and 57. If OK, REPLACE processor. RERUN Quick Test.
	Bright light on one or both tests ▶	CHECK injector circuits 1 and 2 for shorts to ground. If OK, REPLACE processor. RERUN Quick Test.
HD6 INJECTOR BALANCE TEST		
○ Connect tachometer to engine. Run engine at idle. ○ Disconnect and reconnect the injectors one at a time; note rpm drop for each injector. ○ Does each injector produce at least a 100 rpm momentary drop?	Yes ▶	Fuel delivery OK. Problem in area common to all cylinders, i.e.: Air/vacuum leak, fuel contamination, EGR.
	No ▶	REPLACE faulty injector. RERUN Quick Test.

Fuel Control — 3.8L CFI

Pinpoint Test

HD

TEST STEP	RESULT ▶	ACTION TO TAKE
HD7 CODE 41 AND/OR 91 PRESENT		
• Verify codes received during Quick Test. • Are both code 41 and 91 present?	Yes ▶ No ▶	GO to **HD9**. GO to **HD8**.
HD8 SWAP INJECTOR CONNECTORS		
• Key Off. • Swap injector connections. • Start engine, run engine, run Quick Test. • Does the original code(s) repeat?	Yes ▶ No ▶	RECONNECT injector harness to original production state. GO to **HD9**. RECONNECT injector harness to original production state. GO to **HD4**.
HD9 FUEL CONTROL — ALWAYS LEAN CODES: 41 LEFT EGO, 91 RIGHT EGO		
NOTE: Vacuum/air leaks in non-EEC areas could cause a code. Check for: **— Leaking vacuum actuator (eg: A/C control motor)** **— Engine sealing** **— EGR system** **— PCV system** **— Lead contaminated EGO sensor** • Refer to illustration HD. • Key Off. DVOM on 20V scale. Disconnect appropriate EGO sensor from vehicle harness. Connect DVOM to EGO sensor and engine ground. • Apply 14 in.-Hg. of vacuum to MAP sensor. • Start the engine and run at approximately 2000 rpm. Does the DVOM read greater than 0.5V within 1 minute?	Yes ▶ No ▶	GO to **HD10**. REPLACE EGO sensor. RERUN Quick Test.

Fuel Control — 3.8L CFI | Pinpoint Test | HD

TEST STEP	RESULT ▶	ACTION TO TAKE
HD10 HARNESS CHECK EGO CIRCUITS ○ Key Off, wait 10 seconds. ○ Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. ○ Install Breakout box. Processor disconnected. ○ Disconnect appropriate EGO. ○ For left EGO code 41, measure resistance between test Pin 49 at the Breakout box and engine block ground and between left EGO connector and test Pin 29 at the Breakout box. ○ For right EGO code 91 measure resistance between test Pin 44 and engine block ground and also between right EGO harness connector and test Pin 43 at the Breakout box. ○ Are both resistances less than 5 ohms?	Yes ▶	GO to **HD11**.
	No ▶	SERVICE/CORRECT open circuit as necessary. RERUN Quick Test.
HD11 CHECK EGO CIRCUIT FOR SHORT TO GROUND ○ Key Off. ○ Breakout box installed. Processor disconnected. ○ DVOM to 200,000 ohms range. ○ Disconnect appropriate EGO sensor at harness. ○ Measure resistance between test Pin 29 (left EGO) or test Pin 43 (right EGO) to test Pin 40 at the Breakout box.	Reading is 10,000 ohms or greater ▶	GO to **HD12**.
	Reading is less than 10,000 ohms ▶	CORRECT cause of resistance to ground. RERUN Quick Test.
HD12 ATTEMPT TO ELIMINATE EGO LEAN CODE ○ Key Off. ○ Reconnect appropriate EGO sensor. ○ Reconnect processor. ○ Apply 14 in.-Hg. vacuum to MAP sensor. ○ Start the engine and run at approximately 2000 rpm for 1 minute. Allow engine to return to idle. ○ Enter Engine Running Quick Test. ○ Is code 41 or 91 still present? **NOTE: Disregard any other code output at this time.**	Yes ▶	INSPECT for corrosion or damaged pins. If OK, REPLACE processor. RERUN Quick Test.
	No ▶	EGO input circuit OK. GO to **HD13**.

Fuel Control — 3.8L CFI | Pinpoint Test | HD

TEST STEP	RESULT ▶	ACTION TO TAKE
HD13 CHECK FOR CODES WITH ACT RECONNECTED		
• Reconnect ACT sensor. • Repeat Quick Test. • Is code 41 or 91 present?	Yes ▶	REPLACE processor. RERUN Quick Test.
	No ▶	GO to **HD2**.
HD14 FUEL CONTROL — ALWAYS RICH CODES: 42 LEFT EGO, 92 RIGHT EGO		
• Key Off, wait 10 seconds. • **NOTE: Non-EEC areas could cause a code 42. Check for:** **— Fuel contaminated engine oil** **— Ignition caused misfire** **— CANP problems** **— Mechanical portion of EGR system** • Refer to illustration HD. • Disconnect vehicle harness at the appropriate EGO sensor. Using a jumper wire, ground vehicle harness EGO circuit at the EGO sensor to the engine block. • Repeat Engine Running Self-Test. • Is service code 41 or 91 present?	Yes ▶	GO to **HD16**.
	No ▶	GO to **HD15**.
HD15 HARNESS CHECK		
• Key Off, wait 10 seconds. • Refer to illustration HD. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box. • Measure resistance between test Pin 49 at the Breakout box and left EGO ground at engine block or Pin 44 and right EGO ground at engine block. • Measure resistance between test Pin 29 and left EGO harness connector or test Pin 43 and right EGO harness connector. • Are both circuits less than 5 ohms?	Yes ▶	DISCONNECT processor connector. INSPECT for damage or corrosion. If OK, REPLACE processor. RERUN Quick Test.
	No ▶	CORRECT harness circuit with resistance greater than 5 ohms. RERUN Quick Test.

Fuel Control — 3.8L CFI

Pinpoint Test

HD

TEST STEP	RESULT ▶	ACTION TO TAKE
HD16 CHECK MAP SENSOR		
NOTE: Because the MAP sensor influences fuel control, it is possible for a code 42 to occur as a result of a MAP problem even though code 22 is not present. The next 2 steps will verify proper vacuum to the MAP sensor and its ability to hold vacuum.		
o Key Off, wait 10 seconds. o Disconnect vacuum line from MAP sensor. o Install vacuum pump to MAP sensor. o Apply 18 in.-Hg. vacuum to MAP sensor. o Does MAP sensor hold vacuum?	Yes ▶	RELEASE vacuum. GO to **HD17**.
	No ▶	REPLACE MAP sensor. CONNECT vacuum line to MAP sensor. RERUN Quick Test.
HD17 CHECK FOR LOSS OF MAP VACUUM		
o Tee a vacuum gauge in the intake manifold vacuum line at the MAP sensor. o Start engine and note vacuum reading. o Key Off, wait 10 seconds. o Remove vacuum gauge and tee and reconnect line to MAP. o Tee in vacuum gauge at a different source of intake manifold vacuum. o Start engine and note vacuum reading. o Do vacuum readings differ greater than 1 in.-Hg.?	Yes ▶	INSPECT vacuum lines for leaks, holes, disconnections, kinks, blockage and proper routing. SERVICE as necessary.
	No ▶	GO to **HD18**.
HD18 EGO CHECK		
o Refer to illustration HD. o DVOM on 20V scale. o With appropriate EGO sensor disconnected from the vehicle harness, connect a DVOM from EGO sensor to engine ground. o Disconnect PCV hose. o Start engine and run at approximately 2000 rpm. Does the DVOM read less than 0.4V within 1 minute?	Yes ▶	EGO sensor OK. GO to **HD2**.
	No ▶	REPLACE EGO sensor. RERUN Quick Test.

Fuel Control — 3.8L CFI

Pinpoint Test HD

HD19 CONTINUOUS TESTING: CODE 41/42

41 — EGO indicated the fuel system was lean for more than 15 seconds when the system should have been in closed loop fuel control.

42 — EGO indicated the fuel system was rich for more than 15 seconds when the system should have been in closed loop fuel control.

*CLOSED LOOP — Fuel control under the influence of the EGO sensor.

*OPEN LOOP — Fuel control NOT under the influence of the EGO sensor.

Before attempting to correct a fuel control code, 41/42, diagnose all other drive complaints first, eg., rough idle, misses, etc.

NOTE: The fuel control code may help in this diagnosis.

Using the fuel control service code, isolate the cause of the fuel control problem.

Some areas to check are:

• Vacuum Circuits:	Vacuum leaks/intake air leaks. — Canister Purge System. — PCV System. — Engine sealing.
• EGO Fuel Fouled:	Whenever an over-rich fuel condition has been experienced (fuel fouled spark plugs), make a thorough check of the ignition system. In the event the EGO sensor is suspected of being fuel fouled (low output, slow response), run the vehicle at sustained high speeds (within legal limits) followed by a few hard accelerations. This will burn off EGO contamination and restore proper EGO operation.
• Fuel Pressure:	Perform Pinpoint Test Step HD2.
• Ignition System:	Always in default spark (10 degrees). Refer to Quick Test Step 4.0.
• Improper Fueling:	Lead fouled EGO sensor.
• TP Sensor:	Not moving (mechanical damage). Connect DVOM to test Pin 47 and to test Pin 46. Key to Run. Observe DVOM while moving the throttle. Reading must increase with increase in throttle opening. If not correct, SERVICE as necessary.

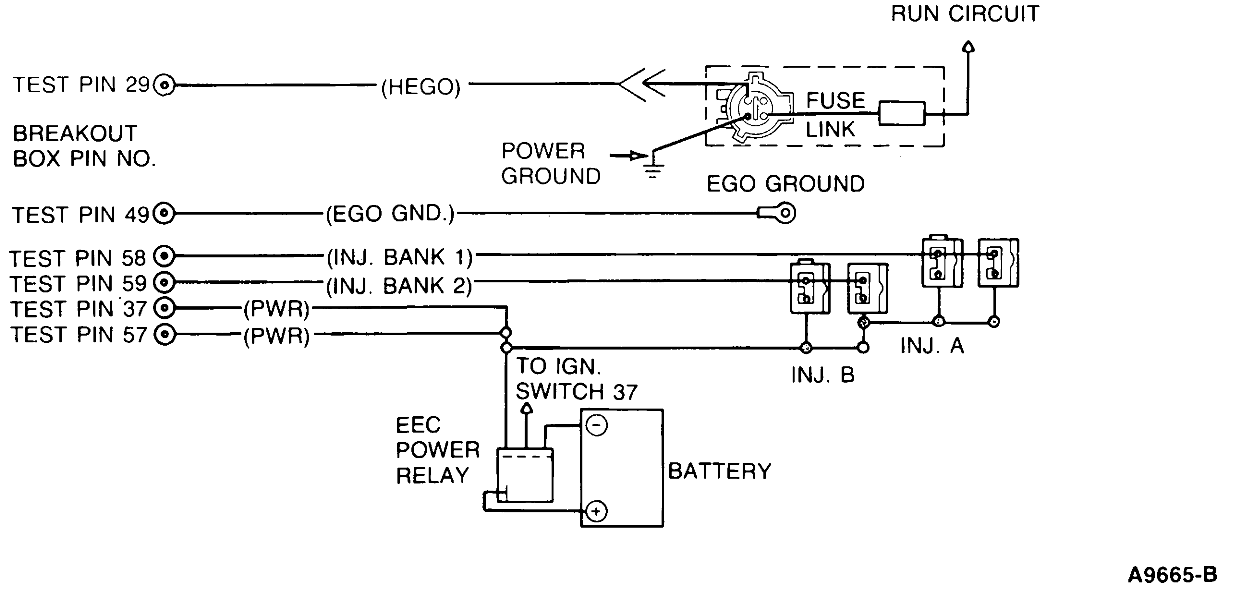
- If at this point, the drive concern is still present, perform Steps HD3 through HD6 only.

Fuel Control — 2.3L EFI Car/Truck

Pinpoint Test

HE

HE



STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 41 or 42 is received in Quick Test Step 5.0 or 6.0 or when directed here from Pinpoint Test A or Diagnostics by Symptom in the Engine Supplement Section.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Ignition Coil
- Distributor Cap
- Distributor Rotor
- Fouled Spark Plugs
- Spark Plug Wires
- CANP Problems
- PCV Valves (see note below)
- EGR Valve and Gasket
- Air Filter
- Fuel Contamination, Engine Oil
- Poor Power Ground
- Fuel Pressure
- Manifold Leaks, Intake/Exhaust
- Engine Not at Normal Operating Temperatures

This Pinpoint Test is intended to diagnose only the following:

- HEGO Sensor
- Harness Circuits HEGO Grd., HEGO, Inj. Bank 1, Inj. Bank 2, V PWR
- HEGO Sensor Connection
  - — Code 42 start at **HE8**
  - — Code 41 start at **HE14**
- Vacuum Systems
- Fuel Injectors
- Processor Assembly

NOTE: Fuel contaminated engine oil may affect 41 and 42 Service Codes. If this is suspected, remove the PCV from the valve cover and repeat the Quick Test. If the problem is corrected, then change the engine oil and filter.

Fuel Control — 2.3L EFI Car/Truck

Pinpoint Test

HE

TEST STEP	RESULT ▶	ACTION TO TAKE
HE1 FUEL PRESSURE CHECK 1		
• Key Off, wait 10 seconds. • Install fuel pressure gauge. • Start and run engine. Fuel pressure must be 206 ± 35 kPa (30 ± 5 psi). **For No Starts:** • If engine will not run, cycle the key from Off to On several times to increase fuel pressure.	Yes ▶	GO to HE2.
	No ▶	REFER to the Shop Manual, Group 24 for electric fuel pump and Section 11 for fuel pressure regulator check.
HE2 FUEL PRESSURE CHECK 2		
• Fuel pressure must remain at 276 ± 34 kPa (40 ± 5 psi) for 60 seconds or longer after final key Off.	Yes ▶	GO to HE3.
	No ▶	GO to HE7.
HE3 FUEL DELIVERY TEST		
• Key Off. • Fuel pressure gauge installed. • Pressurize fuel system as per Step HE1. • Locate and disconnect the fuel pump relay. • Crank engine for 5 seconds. • Take pressure reading at the end of 5 second crank.	PRESSURE GAUGE READING:	
	Pressure is approximately 10-20 psi at the end of 5 second crank cycle. Refer to note below ▶	The EEC system is not the fault of the No Start. Fuel and spark are present. REFER to Section 2 for other No Start Routines. If complaint was runs rough, misses or fuel code, GO to HE4.
	Pressure is greater or less than specified ▶	GO to HE4.

NOTE: The colder the engine, the greater the pressure drop (i.e., an engine coolant temperature of 200°F equals approximately a 10 psi drop in 5 seconds. 60°F equals approximately a 20 psi drop in 5 seconds).

Fuel Control — 2.3L EFI Car/Truck

Pinpoint Test

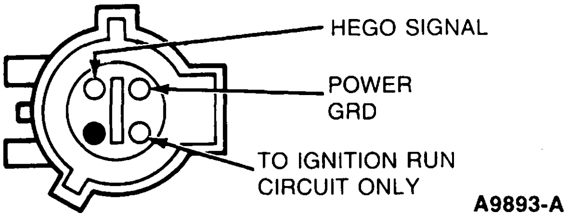
HE

TEST STEP	RESULT ▶	ACTION TO TAKE
HE4 HARNESS INJECTOR RESISTANCE CHECK ○ Key Off, wait 10 seconds. ○ Disconnect processor 60 pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. ○ Connect Breakout box to harness. Leave processor disconnected. ○ DVOM on 200 ohm scale. ○ Measure the resistance of injector Bank 1 between test Pin 37 and test Pin 58 at the Breakout box. Record reading. ○ Measure the resistance of injector Bank 2 between test Pin 37 and test Pin 59 at the Breakout box. Record reading. ○ Are both resistance readings between 7.0 ohms and 9.5 ohms?	Yes ▶	GO to HE6.
	No ▶	GO to HE5.
HE5 ISOLATE FAULTY INJECTOR CIRCUIT ○ Key Off. ○ Breakout box installed. ○ Leave processor disconnected. ○ DVOM on 200 ohm scale. ○ Disconnect all injectors on suspect Bank. Measure the resistance of each injector by connecting one injector at a time, and reading resistance between test Pin 37 and 58 at the Breakout box for Bank 1 or test Pin 37 and 59 at the Breakout box for Bank 2. ○ Are all resistance readings between 15.0 and 19.0 ohms?	Yes ▶	GO to HE6.
	No ▶	SERVICE the harness/connectors on the suspect injector for opens or shorts. If OK, REPLACE injector. RERUN Quick Test.
HE6 INJECTOR DRIVE SIGNAL CHECK **Requires standard non-powered 12-volt test lamp.** ○ Key Off. ○ Breakout box installed. ○ Connect processor to Breakout box. ○ Connect test lamp between test Pin 37 and test Pin 58 at the Breakout box. ○ Crank or start engine. ○ Repeat above test between test Pin 37 and test Pin 59 at the Breakout box.	Dim glow at light on both tests ▶	GO to HE7.
	No light on one or both tests ▶	VERIFY 12-volt battery power at Pins 37 and 57. If OK, REPLACE processor. RERUN Quick Test.
	Bright light on one or both tests ▶	CHECK circuits Bank 1 and Bank 2 for shorts to ground. If OK, REPLACE processor. RERUN Quick Test.

Fuel Control — 2.3L EFI Car/Truck

Pinpoint Test

HE

TEST STEP	RESULT ▶	ACTION TO TAKE
HE7 INJECTOR BALANCE TEST		
• Connect tachometer to engine. Run engine at idle. • Disconnect and reconnect the injectors one at a time; note rpm drop for each injector. • Does each injector produce at least a 100 rpm momentary drop, as ISC will attempt to re-establish rpm?	Yes ▶	Fuel delivery OK. Problem is with area common to all cylinders, i.e.: Air/vacuum leak, fuel contamination, EGR.
	No ▶	REPLACE faulty injector. RERUN Quick Test.
HE8 FUEL CONTROL — ALWAYS RICH: CODE 42, CHECK HEGO HARNESS FOR SHORT TO POWER		
• Key Off, wait 10 seconds. • Disconnect the HEGO sensor from the vehicle harness. • DVOM on 20 volt scale. • Key On. • Measure voltage between HEGO signal and ground at the HEGO connector. • Is voltage reading less than 0.5 volts?  A9893-A	Yes ▶	GO to **HE9**.
	No ▶	SERVICE short to power in HEGO circuit. RERUN Quick Test.
HE9 CHECK HEGO FOR SHORT TO KEY POWER		
• Key Off. • HEGO disconnected. • DVOM on 200,000 ohm scale. • Measure resistance from key power input to HEGO circuit at the HEGO. • Is the resistance reading 10,000 ohms or greater?	Yes ▶	GO to **HE10**.
	No ▶	REPLACE HEGO sensor. RERUN Quick Test.

Fuel Control — 2.3L EFI Car/Truck

Pinpoint Test

HE

TEST STEP	RESULT ▶	ACTION TO TAKE
HE10 ATTEMPT TO GENERATE CODE 41		
◦ Key Off, wait 10 seconds. **NOTE: Non-EEC areas could cause a code 42.** **Check for:** **— Fuel contaminated engine oil** **— Ignition caused misfire** **— CANP problems** ◦ Refer to Illustration HE. ◦ Disconnect vehicle harness at the HEGO sensor. ◦ Jumper (ground) the HEGO circuit at the HEGO sensor vehicle harness connector to the engine block. ◦ Repeat Engine Running Self-Test. ◦ Is service code 41 present?	Yes ▶	REMOVE jumper. GO to HE11.
	No ▶	REMOVE jumper. DISCONNECT the processor and INSPECT pins for damage or corrosion, if OK, REPLACE processor. RERUN Quick Test.
HE11 CHECK MAP SENSOR		
◦ Key Off, wait 10 seconds. ◦ Disconnect vacuum line from MAP sensor. ◦ Install vacuum pump to MAP sensor. ◦ Apply 18 in.-Hg. vacuum to MAP sensor. ◦ Does MAP sensor hold vacuum?	Yes ▶	RELEASE vacuum. GO to HE12.
	No ▶	REPLACE MAP sensor. CONNECT vacuum line to MAP sensor. RERUN Quick Test.
HE12 CHECK FOR LOSS OF MAP VACUUM		
◦ Install vacuum gauge at the MAP sensor and the manifold source. ◦ Start and run engine. ◦ Compare vacuum readings between the MAP sensor and engine manifold. ◦ Are the vacuum readings the same?	Yes ▶	GO to HE13.
	No ▶	INSPECT vacuum lines for leaks, holes, disconnects, kinks, blockage and proper routings. SERVICE as necessary.

Fuel Control — 2.3L EFI Car/Truck

Pinpoint Test

HE

TEST STEP		RESULT ▶	ACTION TO TAKE
HE13	HEGO CHECK		
	• Refer to Illustration HE. • DVOM on 20V scale. • With HEGO sensor disconnected from the harness, connect a DVOM from HEGO sensor to engine ground. • Disconnect PCV hose. • Start engine and run at approximately 2000 rpm. • Does the DVOM read less than 0.4V within 1 minute?	Yes ▶	HEGO sensor OK. GO to HE1.
		No ▶	REPLACE HEGO sensor. RERUN Quick Test.
HE14	FUEL CONTROL — ALWAYS LEAN: CODE 41 VERIFICATION		
	• Run vehicle at 2000 rpm for 2 minutes. • Key Off, wait 10 seconds. • Perform Engine Running Quick Test. • Is code 41 present?	Yes ▶	GO to HE15.
		No ▶	GO to HE21.
HE15	FUEL CONTROL — ALWAYS LEAN		
	NOTE: Vacuum/air leaks in non-EEC areas could cause a code 41. Check for: **— Leaking vacuum actuator (eg: A/C control motor)** **— Engine sealing** **— EGR system** **— PCV system** **— Unmetered air leak between air meter and throttle body** **— Lead contaminated HEGO sensor** • Key Off. DVOM on 20V scale. Disconnect HEGO sensor from vehicle harness. Connect DVOM to HEGO sensor and engine ground. • Apply 14 in.-Hg. vacuum to MAP. • Start the engine and run at approximately 2000 rpm. Does the DVOM read greater than 0.5V within 1 minute?	Yes ▶	GO to HE16.
		No ▶	REPLACE HEGO sensor. RERUN Quick Test.

Fuel Control — 2.3L EFI Car/Truck

Pinpoint Test

HE

TEST STEP	RESULT ▶	ACTION TO TAKE
HE16 HARNESS CHECK HEGO CIRCUITS		
o Key Off. o Install Breakout box. Processor disconnected. o Measure resistance between test Pin 49 at the Breakout box and engine block ground and between HEGO circuit at the HEGO vehicle harness connector and test Pin 29 at the Breakout box. o Are both resistance readings less than 5 ohms?	Yes ▶ No ▶	GO to HE17. SERVICE/CORRECT as necessary, circuit with greater than 5 ohms resistance. RERUN Quick Test.
HE17 CHECK HEGO CIRCUIT FOR SHORT TO GROUND		
o Key Off. o HEGO disconnected. o Breakout box installed. Processor disconnected. o DVOM to 200,000 ohms range. o Measure resistance between test Pin 29 and test Pin 40 at the Breakout box. o Is the resistance reading 10,000 ohms or greater?	Yes ▶ No ▶	GO to HE18. CORRECT cause of resistance to ground. RERUN Quick Test.
HE18 CHECK HEGO SENSOR FOR SHORT TO GROUND		
o Key Off. o HEGO disconnected. o DVOM on 200,000 ohm scale. o Measure resistance from ground to HEGO signal at the HEGO sensor. o Is resistance reading 10,000 ohms or greater?	Yes ▶ No ▶	GO to HE19. REPLACE HEGO sensor. RERUN Quick Test.
HE19 ATTEMPT TO ELIMINATE CODE 41		
o Key Off. o Reconnect HEGO sensor. o Apply 14 in.-Hg. vacuum to MAP sensor. o Start the engine and run at approximately 2000 rpm for 1 minute. Allow engine to return to idle. o Perform Engine Running Self-Test. o Is code 41 still present? **NOTE: Disregard any other code output at this time.**	Yes ▶ No ▶	INSPECT for corrosion or damaged pins. If OK, REPLACE processor. RERUN Quick Test. HEGO input circuit OK. GO to HE1.

Fuel Control — 2.3L EFI Car/Truck

Pinpoint Test

HE

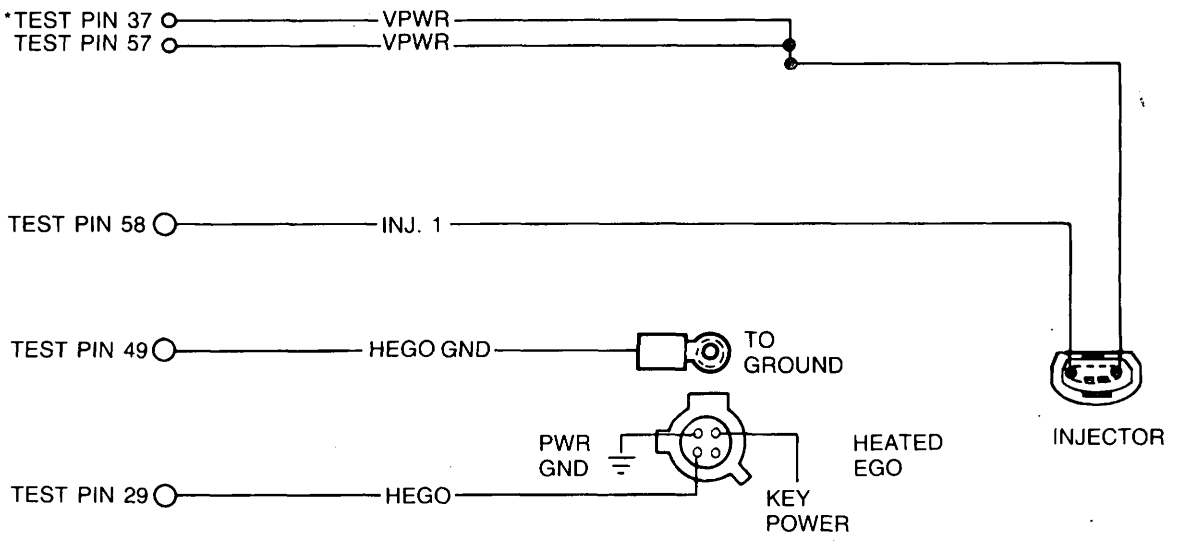
TEST STEP	RESULT ▶	ACTION TO TAKE
HE21 CHECK HEATER ELEMENT RESISTANCE ON HEATED EGO		
• Key Off, Engine Off. • DVOM on 200 ohm scale. • HEGO disconnected. • Measure resistance between run circuit and ground at HEGO sensor. Refer to Pinpoint Test HE for wiring schematic. • Hot to warm resistance specification is 5 to 20 ohms. **NOTE: At room temperature, resistance specification is 2 to 5 ohms.** • Is resistance within specification?	Yes ▶ No ▶	GO to **HE22**. REPLACE HEGO sensor.
HE22 CHECK FOR POWER AT HEGO HARNESS CONNECTOR		
• Key On, Engine Off. • DVOM on 20V scale. • Connect positive lead to run circuit and negative lead to ground at HEGO vehicle harness connector. • Is voltage reading 10.5 volts or greater?	Yes ▶ No ▶	HEGO system OK. RECONNECT HEGO and GO to **HE1**. GO to **HE23**.
HE23 CHECK CONTINUITY OF GROUND TO HEGO CONNECTOR		
• Key Off, wait 10 seconds. • DVOM on 200 ohm scale. • Measure resistance of ground circuit from HEGO vehicle harness connector to battery ground. • Is resistance reading less than 5.0 ohms?	Yes ▶ No ▶	SERVICE open in run circuit. SERVICE open in ground circuit.

Fuel Control — 1.9L CFI and 2.3L/2.5L (HSC) CFI

Pinpoint Test

HF

HF



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

****2.5L CFI RELAY WITHIN INTEGRATED CONTROLLER.**

A9666-B

STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 41 or 42 is received in Quick Test Step 5.0 or 6.0 or when directed here from Pinpoint Test S.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Ignition Coil
- Distributor Cap
- Distributor Rotor
- Fouled Spark Plugs
- Spark Plug Wires
- CANP Problems
- PCV Valves (see note below)
- EGR Valve and Gasket
- Air Filter
- Fuel Contamination, Engine Oil
- Poor Power Ground
- Fuel Pressure
- Manifold Leaks, Intake/Exhaust
- Engine Not at Normal Operating Temperatures

This Pinpoint Test is intended to diagnose only the following:

- EGO Sensor
- EGO Signal and Ground Circuit
- EGO Sensor Connection
- Fuel Injector
- Processor Assembly

NOTE: Fuel contaminated engine oil may affect 41 and 42 Service Codes, so if it is suspected, remove the PCV from the valve cover, and rerun the Quick Test. If the problem is corrected, then change the engine oil and filter.

Fuel Control — 1.9L CFI and 2.3L/2.5L (HSC) CFI

Pinpoint Test

HF

TEST STEP	RESULT ▶	ACTION TO TAKE
HF1 FUEL PRESSURE CHECK 1		
• Key Off, wait 10 seconds. • Install fuel pressure gauge. • Start and run engine.* FUEL PRESSURE SPECIFICATION 1.9L and 2.5L CFI = 13-16 psi (14.5 ± 1.5) 2.3L CFI = 14.5-17.5 psi (16 ± 1.5) ***For No Starts:** • If engine will not run, cycle the key from off to on several times. • Is fuel pressure within specification?	Yes ▶	GO to HF2.
	No ▶	REFER to Shop Manual, Group 24 for electric fuel pump and Section 11 for fuel pressure regulator check.
HF2 FUEL PRESSURE CHECK 2		
• Key On. • Does fuel pressure remain at specification for 60 seconds?	Yes ▶	GO to HF3.
	No ▶	GO to HF25.
HF3 FUEL DELIVERY TEST		
• Key Off. • Fuel pressure gauge installed. • Pressurize fuel system as per Step HF1. • Locate and disconnect the inertia switch. • Crank engine for 5 seconds. • Take pressure reading at the end of 5-second crank. • Does pressure drop approximately 5-8 psi at the end of 5 second crank cycle. Refer to Note below. **NOTE: Verify fuel quality; air and/or water will also pressurize and look like acceptable fuel delivery.**	Yes ▶	The EEC system is not the fault of the No Start. Fuel and spark are present. REFER to Section 2 for other No Start Routines. If complaint was runs rough, misses or fuel code, CONTINUE to HF4.
	No ▶	GO to HF4.

NOTE: The colder the engine, the greater the pressure drop (i.e., an engine coolant temperature of 200°F equals approximately a 5 psi drop in 5 seconds. 60°F equals approximately a 8 psi drop in 5 seconds).

Fuel Control — 1.9L CFI and 2.3L/2.5L (HSC) CFI

Pinpoint Test

HF

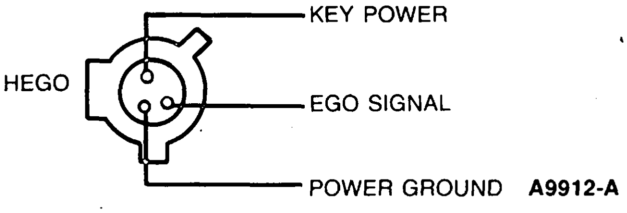
TEST STEP		RESULT ▶	ACTION TO TAKE
HF4	**HARNESS INJECTOR RESISTANCE CHECK**		
	○ Key Off. ○ DVOM on 200 ohm range. ○ Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. ○ Install Breakout box, processor disconnected. ○ Measure resistance between test Pins 57 and 58 at the Breakout box. ○ Is resistance between 1.0 and 2.0 ohms?	Yes ▶	GO to HF5.
		No ▶	SERVICE the harness and/or connectors on the injector for opens or shorts. If OK, REPLACE injector.
HF5	**INJECTOR DRIVE SIGNAL CHECK**		
	Requires standard non-powered 12-volt test lamp. ○ Key Off. ○ Breakout box installed. ○ Connect processor to Breakout box. ○ Refer to illustration HF. ○ Connect test lamp between test Pin 37 and test Pin 58 at the Breakout box. ○ Crank or start engine.	Very dim glow at light ▶	Fuel delivery OK. Problem is with area common to all cylinders, i.e., air/vacuum leak, fuel contamination, EGR.
		No light ▶	VERIFY 12-volt battery power at Pins 37 and 57. If OK, REPLACE processor. RERUN Quick Test.
		Bright light ▶	CHECK injector circuit for shorts to ground. If OK, REPLACE processor. RERUN Quick Test.
HF6	**FUEL CONTROL — ALWAYS LEAN: CODE 41 VERIFICATION**		
	○ Run vehicle at 2000 rpm for 2 minutes. ○ Key Off, wait 10 seconds. ○ Perform Engine Running Quick Test. ○ Is code 41 present?	Yes ▶	GO to HF7.
		No ▶	GO to HF20.

PLEASE REFER TO TSB 88-5-11 FOR: REVISED FUEL CONTROL PINPOINT TEST DIAGNOSTICS.

Fuel Control — 1.9L CFI and 2.3L/2.5L (HSC) CFI | Pinpoint Test | HF

TEST STEP	RESULT ▶	ACTION TO TAKE
HF7 FUEL CONTROL — INDICATES LEAN: CODE 41		
NOTE: Vacuum/air leaks in non-EEC areas could cause a code 41. Check for: **— Leaking vacuum actuator (eg: A/C control motor)** **— Engine sealing** **— EGR system** **— PCV system** **— Lead contaminated HEGO sensor** • Refer to illustration HF. • Key Off. DVOM on 20V scale. Disconnect HEGO sensor from vehicle harness. Connect DVOM to EGO signal at HEGO sensor and engine ground. • Apply 14 in.-Hg. vacuum to MAP. • Start the engine and run at approximately 2000 rpm. Does the DVOM read greater than 0.5V within 60 seconds?	Yes ▶ No ▶	GO to HF8. REPLACE HEGO sensor. RERUN Quick Test.
HF8 HARNESS CHECK HEGO CIRCUITS		
• Key Off. • Install Breakout box. Processor disconnected. • HEGO disconnected. • Measure resistance between test Pin 49 at the Breakout box and engine block ground and between EGO circuit at the HEGO vehicle harness connector and test Pin 29 at the Breakout box. • Are both resistance readings less than 5 ohms?	Yes ▶ No ▶	GO to HF9. SERVICE/CORRECT circuit with resistance greater than 5 ohms, as necessary. RERUN Quick Test.
HF9 CHECK HEGO CIRCUIT FOR SHORT TO GROUND		
• Key Off. • HEGO disconnected. • Breakout box installed. Processor disconnected. • DVOM to 200,000 ohms range. • Measure resistance between test Pin 29 and test Pin 40 at the Breakout box. • Is resistance 10,000 ohms or greater?	Yes ▶ No ▶	GO to HF10. CORRECT cause of resistance to ground. RERUN Quick Test.

Fuel Control — 1.9L CFI and 2.3L/2.5L (HSC) CFI | Pinpoint Test | HF

TEST STEP	RESULT ▶	ACTION TO TAKE
HF10 CHECK HEGO SENSOR TO GROUND ○ Key Off. ○ HEGO disconnected. ○ DVOM on 200,000 ohm scale. ○ Measure resistance between power ground and EGO signal at HEGO sensor. ○ Is resistance 10,000 ohms or greater?	Yes ▶	GO to **HF11**.
	No ▶	REPLACE HEGO sensor. RERUN Quick Test.
HF11 ATTEMPT TO ELIMINATE CODE 41 ○ Key Off. ○ Reconnect HEGO sensor. ○ Apply 14 in.-Hg. vacuum to MAP. ○ Start the engine and run at approximately 2000 rpm for 1 minute, allow engine to return to idle. ○ Perform Engine Running Self-Test. ○ Is code 41 still present? **NOTE: Disregard any other code output at this time.**	Yes ▶	INSPECT for corrosion or damaged pins. If OK, REPLACE processor. RERUN Quick Test.
	No ▷	HEGO input circuit OK. GO to **HF1**.
HF13 FUEL CONTROL — ALWAYS RICH: CODE 42 CHECK HEGO HARNESS FOR SHORT TO POWER ○ Key Off, wait 10 seconds. ○ Disconnect vehicle harness at the HEGO sensor. ○ DVOM on 20 volt scale. ○ Key On. ○ Measure voltage between EGO signal and power ground at the HEGO harness connector.  ○ Is voltage less than .5 volts?	Yes ▶	GO to **HF14**.
	No ▶	REPAIR short to power in EGO circuit. RERUN Quick Test. If code 41 is now present, REPLACE HEGO.

Fuel Control — 1.9L CFI and 2.3L/2.5L (HSC) CFI

Pinpoint Test

HF

TEST STEP	RESULT ▶	ACTION TO TAKE
HF14 CHECK HEGO FOR SHORT TO KEY POWER		
• Key Off. • HEGO disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between key power input and EGO circuit at the HEGO sensor. • Is resistance 10,000 ohms or greater.	Yes ▶	GO to HF15.
	No ▶	REPLACE HEGO sensor. RERUN Quick Test.
HF15 ATTEMPT TO GENERATE CODE 41		
• Key Off, wait 10 seconds. • **NOTE: Non-EEC areas could cause code 42. Check for:** **— Fuel contaminated engine oil** **— Ignition caused misfire (fouled spark plug)** **— CANP problems** **— Mechanical portion EGR system** • Refer to illustration HF. • Disconnect vehicle harness at the HEGO sensor. Jumper (ground) the EGO circuit at the HEGO sensor vehicle harness connector to the engine block. • Repeat Engine Running Self-Test. • Service code 41 results.	Yes ▶	DISCONNECT jumper to ground. GO to HF16.
	No ▶	DISCONNECT processor connector. INSPECT for damage or corrosion. If OK, REPLACE Processor. RERUN Quick Test.
HF16 CHECK MAP SENSOR		
NOTE: Due to the MAP sensors large influence on fuel control, there is a possibility that a code 42 could be a result of a MAP problem, even though a code 22 is not present. Therefore, in the next two Pinpoint Test Steps we will verify proper vacuum to MAP, and its ability to hold it. • Key Off, wait 10 seconds. • Disconnect vacuum line from MAP sensor. • Install vacuum pump to MAP sensor. • Apply 18 in.-Hg. vacuum to MAP sensor. • Does MAP sensor hold vacuum?	Yes ▶	RELEASE vacuum. GO to HF17.
	No ▶	REPLACE MAP sensor. CONNECT vacuum line to MAP sensor. RERUN Quick Test.

Fuel Control — 1.9L CFI and 2.3L/2.5L (HSC) CFI

Pinpoint Test

HF

TEST STEP		RESULT ▶	ACTION TO TAKE
HF17	CHECK FOR LOSS OF VACUUM TO MAP		
	• Tee a vacuum gauge in the intake manifold vacuum hose at the MAP sensor. • Start engine and let RPM stabilize. NOTE vacuum reading. • Key Off, wait 10 seconds. • Remove vacuum gauge and tee and reconnect vacuum line to MAP. • Tee in vacuum gauge at a different source of intake manifold vacuum. • Start engine and let RPM stabilize. NOTE vacuum reading. • Do the vacuum readings differ greater than 1 in.-Hg.?	Yes ▶	INSPECT vacuum lines for leaks, holes, disconnections, kinks, blockage and proper routing. SERVICE as necessary.
		No ▶	REMOVE vacuum gauge and tee. GO to **HF18**.
HF18	HEGO CHECK		
	• Refer to illustration HF. • DVOM on 20V scale. • HEGO sensor disconnected. • Connect a DVOM from EGO circuit on sensor to engine ground. • Disconnect PCV hose. • Start engine and run at approximately 2000 rpm. Does the DVOM read less than 0.4V within 30 seconds?	Yes ▶	HEGO sensor OK. GO to **HF1**.
		No ▶	REPLACE HEGO sensor. RERUN Quick Test.
HF20	CHECK HEATER ELEMENT RESISTANCE ON HEATED EGO		
	• Key Off Engine Off. • DVOM on 200 ohm scale. • HEGO disconnected. • Measure resistance between run circuit and ground at HEGO sensor. — Refer to pinpoint test HF wiring schematic. • Hot to warm resistance specification is 5 to 20 ohms. NOTE: At room temperature, resistance specification is 2 to 5 ohms. • Is resistance within specification?	Yes ▶	GO to **HF21**.
		No ▶	REPLACE HEGO sensor.

Fuel Control — 1.9L CFI and 2.3L/2.5L (HSC) CFI

Pinpoint Test

HF

TEST STEP	RESULT ▶	ACTION TO TAKE
HF21 CHECK FOR POWER AT HEGO HARNESS CONNECTOR		
• Key On Engine Off. • DVOM on 20V scale. • Connect positive lead to run circuit and negative lead to ground at HEGO vehicle harness connector. • Is voltage 10.5V or greater?	Yes ▶ No ▶	HEGO sensor system OK. RECONNECT HEGO. GO to HF1. GO to HF22.
HF22 CHECK CONTINUITY OF GROUND TO HEGO CONNECTOR		
• Key Off, wait 10 seconds. • DVOM on 200 ohm scale. • Measure resistance of ground circuit from HEGO vehicle harness connector to battery ground. • Is resistance less than 5.0 ohms?	Yes ▶ No ▶	SERVICE open in run circuit. SERVICE open in ground circuit.
HF25 LEAKING INJECTOR		
• Remove air inlet tube at fuel charging assembly. • Pressurize fuel system as per Test Step HF1. • Key Off. • Observe throughout the air horn inlet for fuel leaking and/or weeping at the fuel injector discharge area. • Is there a visible leak?	Yes ▶ No ▶	SERVICE injector and/or O-rings as necessary. REFER to Shop Manual, Section 24-03 for service procedure. **NOTE: After having completed service, RERUN Quick Test.** GO to HF26.
HF26 EXTERNAL FUEL LEAKS		
• Pressurized fuel system as per Test Step HF1. • Key Off. • Look for fuel leak external to fuel charging assembly fuel line, fitting, etc. • Is there a visible leak?	Yes ▶ No ▶	SERVICE as necessary. RERUN Quick Test. SERVICE fuel pressure regulator as necessary. REFER to Shop Manual, Section 24-03 for service procedure. **NOTE: After having completed service, RERUN Quick Test.**

Fuel Control — 1.9L CFI and 2.3L/2.5L (HSC) CFI

Pinpoint Test

HF

HF90 CONTINUOUS TESTING: CODE 41

CODE 41 — Indicates that the EGO circuit has not switched during closed loop fuel control.

NOTE: In this situation, code 41 does not necessarily indicate a lean condition.

CLOSED LOOP — Fuel control under the influence of the HEGO sensor.

OPEN LOOP — Fuel control NOT under the influence of the HEGO sensor.

Before attempting to correct a continuous fuel control code 41, diagnose all other drive complaints first, eg., rough idle, misses, etc. in EEC Diagnostic By Symptom in the appropriate engine supplement.

NOTE: The fuel control code may help in this diagnosis.

Using the fuel control service code, isolate the cause of the fuel control problem.

Some areas to check are:

• Vacuum Circuits:	Vacuum leaks/intake air leaks. — Canister Purge System. — PCV System. — Engine sealing.
• EGO Fuel Fouled:	Whenever an over-rich fuel condition has been experienced (fuel fouled spark plugs), make a thorough check of the ignition system. In the event the HEGO sensor is suspected of being fuel fouled (low output, slow response), run the vehicle at sustained high speeds (within legal limits) followed by a few hard accelerations. This will burn off HEGO contamination and restore proper HEGO operation.
• Ignition System:	Always in default spark (10 degrees). Refer to Quick Test Step $\boxed{4.0}$.
• Improper Fueling:	Lead fouled HEGO sensor.
• Fuel Pressure:	Perform Pinpoint Test Step $\boxed{HF1}$ and $\boxed{HF2}$.

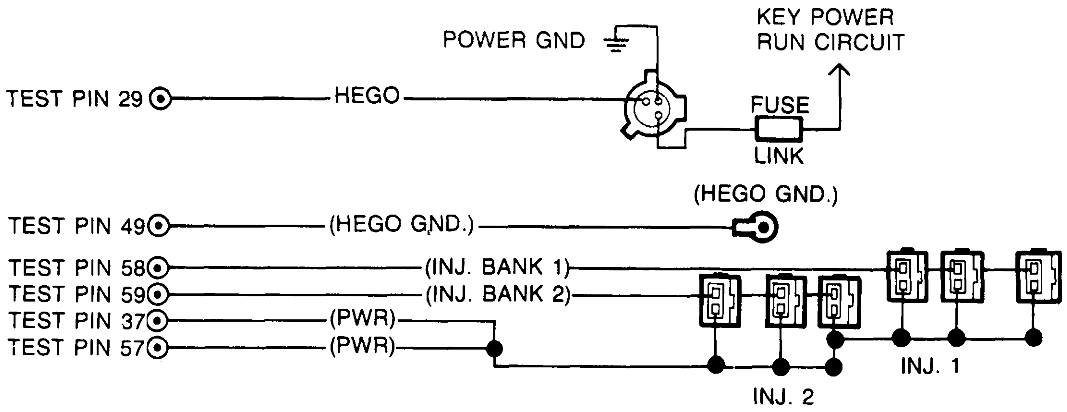
- If at this point, the drive concern (if any) is still present, perform Steps $\boxed{HF3}$ through $\boxed{HF5}$ only.

Fuel Control — 2.9L, 3.0L and 4.9L EFI 6-Cylinder Engines

Pinpoint Test

HG

HG



NOTE: REFER TO APPROPRIATE ENGINE SUPPLEMENT FOR PROPER INJECTOR BANK-TO-INJECTOR RELATIONSHIP.

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STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 41 or 42 is received in Quick Test Step 5.0 or 6.0 or when directed here from Pinpoint Test S or Diagnostics by Symptom in the Engine Supplement Section.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Ignition Coil
- Distributor Cap
- Distributor Rotor
- Fouled Spark Plugs
- Spark Plug Wires
- CANP Problems
- PCV Valves (see note below)
- EGR Valve and Gasket
- Air Filter
- Fuel Contamination, Engine Oil
- Poor Power Ground
- Fuel Pressure
- Manifold Leaks, Intake/Exhaust
- Engine Not at Normal Operating Temperatures

This Pinpoint Test is intended to diagnose only the following:

- HEGO Sensor
- Harness Circuits EGO Grd., HEGO, Inj. Bank 1, Inj. Bank 2, VPWR
- HEGO Sensor Connection
- Vacuum Systems
- Fuel Injectors
- Processor Assembly

NOTE: Fuel contaminated engine oil may affect 41 and 42 Service Codes. If this is suspected, remove the PCV from the valve cover and repeat the Quick Test. If the problem is corrected, then change the engine oil and filter.

Fuel Control — 2.9L, 3.0L and 4.9L EFI 6-Cylinder Engines

Pinpoint Test

HG

TEST STEP	RESULT ▶	ACTION TO TAKE
HG1 FUEL PRESSURE CHECK 1		
○ Key Off, wait 10 seconds. ○ Install fuel pressure gauge. ○ Start and run engine. RUNNING FUEL PRESSURE SPECIFICATION 2.9L and 3.0L = 28-38 psi (33 ± 5) 4.9L = 42-52 psi (47 ± 5) ENGINE OFF FUEL PRESSURE SPECIFICATION 2.9L and 3.0L = 35-45 psi (40 ± 5) 4.9L = 50-60 psi (55 ± 5) ○ Is fuel pressure within specification? **For No Starts:** ○ If engine will not run, cycle the key from Off to On several times to increase fuel pressure.	Yes ▶ No ▶	GO to HG2. REFER to the Shop Manual, Group 24 for electric fuel pump and Section 11 for fuel pressure regulator check.
HG2 FUEL PRESSURE CHECK 2		
○ Key On. ○ Does fuel pressure remain at specification for 60 seconds?	Yes ▶ No ▶	GO to HG3. GO to HG7.
HG3 FUEL DELIVERY TEST		
○ Key Off. ● Fuel pressure gauge installed. ● Pressurize fuel system as per Step HG1. ● Locate and disconnect the inertia switch which disables fuel pump. ○ Crank engine for 5 seconds. ○ Take pressure reading at the end of 5 second crank. ○ Does pressure drop approximately 5-8 psi at the end of crank cycle? Refer to Notes below. **NOTE: Verify fuel quality; air and/or water will also pressurize and look like acceptable fuel delivery.**	Yes ▶ No ▶	The EEC system is not the fault of the No Start. Fuel and spark are present. REFER to Section 2 for other No Start Routines. If complaint was runs rough, misses or fuel code, GO to HG4. GO to HG4.

NOTE: The colder the engine, the greater the pressure drop (for example, an engine coolant temperature of 200°F equals approximately a 69 kPa [10 psi] drop in 5 seconds. 60°F equals approximately a 138 kPa [20 psi] drop in 5 seconds).

Fuel Control — 2.9L, 3.0L and 4.9L EFI 6-Cylinder Engines

Pinpoint Test

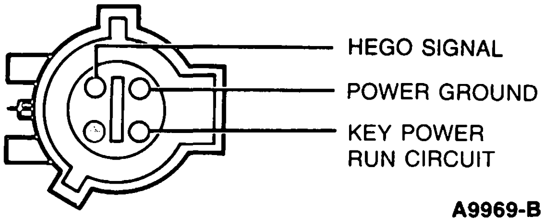
HG

TEST STEP	RESULT ▶	ACTION TO TAKE
HG4 HARNESS INJECTOR RESISTANCE CHECK		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Connect Breakout box to harness. Leave processor disconnected. • DVOM on 200 ohm scale. • Measure the resistance of injector Bank 1 between test Pin 37 and test Pin 58 at the Breakout box. • Measure the resistance of injector Bank 2 between test Pin 37 and test Pin 59 at the Breakout box. • Are both readings between 5.0 and 6.5 ohms?	Yes ▶	GO to HG6.
	No ▶	GO to HG5.
HG5 ISOLATE FAULTY INJECTOR CIRCUIT		
• Key Off. • Breakout box installed. • Leave processor disconnected. • DVOM on 200 ohm scale. • Disconnect all injectors on suspect Bank. Measure the resistance of each injector by connecting one injector at a time, and reading resistance between test Pin 37 and 58, for Bank 1, or test Pin 37 and 59, for Bank 2, at the Breakout box. • Are all readings between 16.0 and 18.0 ohms?	Yes ▶	GO to HG6.
	No ▶	SERVICE the harness and/or connectors on the suspect injector for opens or shorts. If OK, REPLACE injector. RERUN Quick Test.
HG6 INJECTOR DRIVE SIGNAL CHECK		
Requires standard non-powered 12-volt test lamp. • Key Off. • Breakout box installed. • Connect processor to Breakout box. • Connect test lamp between test Pin 37 and test Pin 58 at the Breakout box. • Crank or start engine. • Repeat above test between test Pin 37 and test Pin 59 at the Breakout box.	Dim glow at light on both tests ▶	GO to HG7.
	No light on one or both tests ▶	VERIFY 12V battery power at Pins 37 and 57. If OK, REPLACE processor. RERUN Quick Test.
	Bright light on one or both tests ▶	CHECK circuits Bank 1 and Bank 2 for shorts to ground. If OK, REPLACE processor. RERUN Quick Test.

Fuel Control — 2.9L, 3.0L and 4.9L EFI 6-Cylinder Engines

Pinpoint Test

HG

TEST STEP	RESULT ▷	ACTION TO TAKE
HG7 INJECTOR BALANCE TEST		
○ Connect tachometer to engine. Run engine at idle. ○ Disconnect and reconnect the injectors one at a time; note rpm drop for each injector. ○ Does each injector produce at least a 100 rpm momentary drop? ISC will attempt to reestablish rpm.	Yes ▷	Fuel delivery OK. Problem is with area common to all cylinders, i.e.: Air/ vacuum leak, fuel contamination, EGR.
	No ▷	REPLACE faulty injector. RERUN Quick Test.
HG8 FUEL CONTROL — ALWAYS RICH: CODE 42. CHECK HEGO HARNESS FOR SHORT TO POWER		
○ Key Off, wait 10 seconds. ○ Disconnect vehicle harness at the HEGO sensor. ○ DVOM on 20 volt scale. ○ Key On. ○ Measure voltage between EGO signal and power ground at the HEGO harness connector.  A9969-B ○ Is voltage less than .5 volts?	Yes ▷	GO to HG9.
	No ▷	REPAIR short to power in EGO circuit. RERUN Quick Test.
HG9 CHECK HEGO FOR SHORT TO KEY POWER		
○ Key Off. ○ HEGO sensor disconnected. ○ DVOM on 200,000 ohm scale. ○ Measure resistance between key power input to EGO circuit at the HEGO sensor. ○ Is reading 10,000 ohms or less?	Yes ▷	REPLACE HEGO sensor. RERUN Quick Test.
	No ▷	GO to HG10.

Fuel Control — 2.9L, 3.0L and 4.9L EFI 6-Cylinder Engines

Pinpoint Test

HG

TEST STEP	RESULT ▶	ACTION TO TAKE
HG10 ATTEMPT TO GENERATE CODE 41		
• Key Off, wait 10 seconds. • **NOTE: Non-EEC areas could cause a code 42. Check for:** **— Fuel contaminated engine oil** **— Ignition caused misfire (fouled spark plug)** **— CANP problems** • Refer to illustration HF. • Disconnect vehicle harness at the EGO sensor. Jumper (ground) the EGO circuit at the EGO sensor vehicle harness connector to the engine block. • Repeat Engine Running Self-Test. • Service code 41 results.	Yes ▶ No ▶	REMOVE jumper. GO to HG11. REMOVE jumper. DISCONNECT processor connector. INSPECT for damage or corrosion. If OK, REPLACE processor. RERUN Quick Test.
HG11 CHECK MAP SENSOR		
NOTE: Due to the MAP sensor influence on fuel control, there is a possibility that a code 42 could be a result of a MAP problem even though a code 22 is not present. The next two Pinpoint Test steps will verify proper vacuum to the MAP sensor and the ability to hold vacuum. • Key Off, wait 10 seconds. • Disconnect vacuum line from MAP sensor. • Install vacuum pump to MAP sensor. • Apply 18 in.-Hg. vacuum to MAP sensor. • Does MAP sensor hold vacuum?	Yes ▶ No ▶	RELEASE vacuum. GO to HG12. REPLACE MAP sensor. CONNECT vacuum line to MAP sensor. RERUN Quick Test.

Fuel Control — 2.9L, 3.0L and 4.9L EFI 6-Cylinder Engines

Pinpoint Test

HG

TEST STEP	RESULT ▶	ACTION TO TAKE
HG12 CHECK FOR LOSS OF MAP VACUUM o Tee a vacuum gauge in the intake manifold vacuum line at the MAP sensor. o Start engine and note vacuum reading. o Key Off, wait 10 seconds. o Remove vacuum gauge and tee and reconnect vacuum line to MAP. o Tee in vacuum gauge at a different source of intake manifold vacuum. o Start engine and note vacuum reading. o Do vacuum readings differ by greater than 1 in.-Hg.?	Yes ▶	INSPECT vacuum lines for leaks, holes, disconnections, kinks, blockage and proper routing. SERVICE as necessary.
	No ▶	GO to HG13.
HG13 EGO CHECK o Refer to Illustration HG. o DVOM on 20V scale. o With EGO sensor disconnected from the harness, connect a DVOM from EGO sensor to engine ground. o Disconnect PCV hose. o Start engine and run at approximately 2000 rpm. Does the DVOM read less than 0.4V within 30 seconds?	Yes ▶	EGO sensor OK. GO to HG1.
	No ▶	REPLACE EGO sensor. RERUN Quick Test.
HG15 FUEL CONTROL — ALWAYS LEAN: CODE 41 VERIFICATION o Run vehicle at 2000 rpm for 2 minutes. o Key Off, wait 10 seconds. o Perform Engine Running Quick Test. o Is code 41 still present?	Yes ▶	GO to HG16.
	No ▶	GO to HG21.

Fuel Control — 2.9L, 3.0L and 4.9L EFI 6-Cylinder Engines

Pinpoint Test

HG

TEST STEP	RESULT ▶	ACTION TO TAKE
HG16 FUEL CONTROL — INDICATES LEAN 41		
NOTE: Vacuum/air leaks in non-EEC areas could cause a code 41. Check for: **— Leaking vacuum actuator (e.g.: A/C control motor)** **— Engine sealing** **— EGR system** **— PCV system** **— Lead contaminated HEGO sensor** • Key Off. DVOM on 20V scale. Disconnect HEGO sensor from vehicle harness. Connect DVOM to HEGO sensor and engine ground. • Disconnect and plug vacuum line to MAP sensor. • Apply 10 in.-Hg. vacuum to MAP sensor. • Start the engine and run at approximately 2000 rpm. Does the DVOM read greater than 0.5V within 1 minute?	Yes ▶	GO to HG17.
	No ▶	REPLACE HEGO sensor. RECONNECT MAP vacuum line. RERUN Quick Test.
HG17 HARNESS CHECK HEGO CIRCUITS		
• Key Off. • Install Breakout box. Processor disconnected. • Measure resistance between test Pin 49 at the Breakout box and engine block ground and between HEGO circuit at the HEGO vehicle harness connector and test Pin 29 at the Breakout box. • Are both circuits less than 5 ohms?	Yes ▶	GO to HG18.
	No ▶	SERVICE/CORRECT as necessary circuit with greater than 5 ohms resistance. RECONNECT MAP vacuum line. RERUN Quick Test.
HG18 CHECK HEGO CIRCUIT FOR SHORT TO GROUND		
• Key Off. • EGO disconnected. • Breakout box installed. Processor disconnected. • DVOM to 200,000 ohms range. • Measure resistance between test Pin 29 and test Pin 40 at the Breakout box. • Is resistance 10,000 ohms or greater?	Yes ▶	GO to HG19.
	No ▶	CORRECT cause of resistance to ground. RECONNECT MAP vacuum line RERUN Quick Test.

Fuel Control — 2.9L, 3.0L and 4.9L EFI 6-Cylinder Engines

Pinpoint Test

HG

TEST STEP	RESULT ▶	ACTION TO TAKE
HG19 CHECK HEGO SENSOR TO GROUND		
• Key Off. • HEGO disconnected. • DVOM on 200,000 ohm scale. • Measure resistance from power ground to HEGO signal at HEGO sensor. • Is reading 10,000 ohms or less?	Yes ▶	REPLACE HEGO sensor. RECONNECT MAP vacuum line. RERUN Quick Test.
	No ▶	GO to **HG20**.
HG20 ATTEMPT TO ELIMINATE CODE 41		
• Key Off. • Processor connected. • Reconnect HEGO sensor. • MAP vacuum line still disconnected and plugged. • Apply 10 in.-Hg. vacuum to MAP sensor. • Start the engine and run at approximately 2000 rpm for 1 minute. Allow engine to return to idle. • Perform Engine Running Self-Test. • Is code 41 still present? **NOTE: Disregard any other code input at this time.**	Yes ▶	INSPECT for corrosion or damaged pins. If OK, REPLACE processor. RECONNECT MAP vacuum line. RERUN Quick Test.
	No ▶	RECONNECT MAP vacuum line. HEGO input circuit OK. GO to **HG1** (Basic Fuel Delivery).
HG21 CHECK HEATER ELEMENT RESISTANCE ON HEATED EGO		
• Key Off, Engine Off. • DVOM on 200 ohm scale. • HEGO sensor disconnected. • Measure resistance between run circuit and power ground at the heated EGO sensor. Refer to Pinpoint Test HG wiring schematic. • Hot to warm resistance is 5-20 ohms. **NOTE: At room temperature, resistance specification is 2-5 ohms.** • Is resistance within specification?	Yes ▶	GO to **HG22**.
	No ▶	REPLACE HEGO sensor.

Fuel Control — 2.9L, 3.0L and 4.9L EFI 6-Cylinder Engines

Pinpoint Test

HG

TEST STEP	RESULT ▶	ACTION TO TAKE
HG22 CHECK FOR POWER AT HEGO HARNESS CONNECTOR		
• Key On, Engine Off. • DVOM on 20V scale. • Connect positive lead to run circuit and negative lead to ground at HEGO vehicle harness connector.	Yes ▶	HEGO sensor system OK. RECONNECT HEGO and GO to HG1.
• Is voltage reading 10.5 volts or greater?	No ▶	GO to HG23.
HG23 CHECK CONTINUITY OF GROUND TO HEGO CONNECTOR		
• Key Off, wait 10 seconds. • DVOM on 200 ohm scale.	Yes ▶	SERVICE open in run circuit.
• Measure resistance of power ground circuit from HEGO vehicle harness connector to battery ground. • Is resistance reading 5.0 ohms or less?	No ▶	SERVICE open in power ground circuit.

Fuel Control — 2.9L, 3.0L and 4.9L EFI 6-Cylinder Engines

EFI Pinpoint Test

HG

HG90 CONTINUOUS TESTING: CODE 41

Code 41: Indicates that the EGO circuit has not switched during closed loop fuel control.

NOTE: In this situation code 41 does not necessarily indicate a lean condition.

CLOSED LOOP — Fuel control under the influence of the EGO sensor.

OPEN LOOP — Fuel control NOT under the influence of the EGO sensor.

Before attempting to correct continuous code 41, diagnose all other drive complaints first, eg., rough idle, misses, etc. in EEC Diagnostic By Symptom in the appropriate engine supplement.

NOTE: The fuel control code may help in this diagnosis.

Using the fuel control service code, isolate the cause of the fuel control problem.

Some areas to check are:

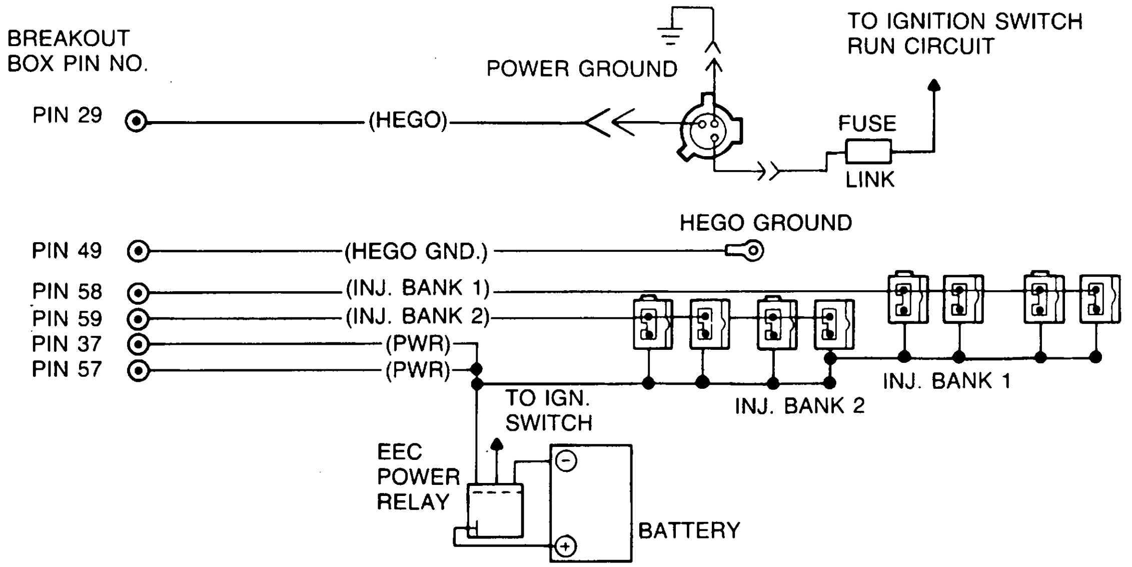
- Vacuum Circuits:
  - — Vacuum leaks/intake air leaks.
  - — PCV System.
  - — Engine sealing.
- EGO Fuel Fouled: Whenever an over-rich fuel condition has been experienced (fuel fouled spark plugs), make a thorough check of the ignition system. In the event the EGO sensor is suspected of being fuel fouled (low output, slow response), run the vehicle at sustained high speeds (within legal limits) followed by a few hard accelerations. This will burn off EGO contamination and restore proper EGO operation.
- Ignition System: Always in default spark (10 degrees). Refer to Quick Test Step **4.0**.
- Improper Fueling: Lead fouled EGO sensor.
- Fuel Pressure: Perform Pinpoint Test Step **HG1** and **HG2**.
- If at this point, the drive concern (if any) is still present, perform Steps **HG3** and **HG7** only.

Fuel Control – 5.0L/7.5L EFI Truck

Pinpoint Test

HH

HH



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STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 41 or 42 is received in Quick Test Step 5.0 or 6.0 or when directed here from Pinpoint Test S.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Ignition Coil
- Distributor Cap
- Distributor Rotor
- Fouled Spark Plugs
- Spark Plug Wires
- CANP Problems
- PCV Valves (see note below)
- EGR Valve and Gasket
- Air Filter
- Fuel Contamination, Engine Oil
- Poor Power Ground
- Fuel Pressure
- Manifold Leaks, Intake/Exhaust
- Engine Not at Normal Operating Temperatures

This Pinpoint Test is intended to diagnose only the following:

- HEGO Sensor
- Harness Circuits HEGO Grd., HEGO, Inj. Bank 1, Inj. Bank 2, VPWR
- HEGO Sensor Connection
  - — Code 42 start at HH8
  - — Code 41 start at HH15
- Vacuum Systems
- Fuel Injectors
- Processor Assembly
- MAP Sensor (generating fuel codes)

NOTE: Fuel contaminated engine oil may affect 41 and 42 Service Codes. If this is suspected, remove the PCV from the valve cover and repeat the Quick Test. If the problem is corrected, then change the engine oil and filter.

Fuel Control — 5.0L/7.5L EFI Truck

Pinpoint Test

HH

TEST STEP	RESULT ▷	ACTION TO TAKE
HH1 FUEL PRESSURE CHECK 1		
○ Key Off, wait 10 seconds. ○ Install fuel pressure gauge. ○ Start and run engine. Fuel pressure must be 28-38 psi (193-262 kPa). **For No Starts:** ○ If engine will not run, cycle the key from Off to On several times to increase fuel pressure. ○ Is fuel pressure 35-45 psi (241-310 kPa)?	Yes ▷	GO to HH2.
	No ▷	REFER to the Shop Manual, Group 24 for electric fuel pump and Section 11 for fuel pressure regulator check.
HH2 FUEL PRESSURE CHECK 2		
○ Key On. ○ Does fuel pressure remain at 35-45 psi (241-310 kPa) for 60 seconds or longer after final key off?	Yes ▷	GO to HH3.
	No ▷	GO to HH7.
HH3 FUEL DELIVERY TEST		
○ Key Off. ○ Fuel pressure gauge installed. ○ Pressurize fuel system as per Step HH1. ○ Locate and disconnect the fuel pump inertia switch (disables pump). ○ Crank engine for 5 seconds. ○ Take pressure reading at the end of 5 second crank. **NOTE: Verify fuel quality; air and/or water will also pressurize and look like acceptable fuel delivery.**	PRESSURE GAUGE READING: Pressure is approximately 10-20 psi at the end of 5 second crank cycle. Refer to note below ▷	The EEC system is not the fault of the No Start. Fuel and spark are present. REFER to Section 2 for other No Start Routines. If complaint was runs rough, misses or fuel code, GO to HH4.
	Pressure is greater or less than specified ▷	GO to HH4.

NOTE: The colder the engine, the greater the pressure drop (i.e., an engine coolant temperature of 200°F equals approximately a 10 psi drop in 5 seconds. 60°F equals approximately a 20 psi drop in 5 seconds).

Fuel Control — 5.0L/7.5L EFI Truck

Pinpoint Test

HH

TEST STEP	RESULT ▶	ACTION TO TAKE
HH4 HARNESS AND INJECTOR RESISTANCE CHECK		
• Key Off, wait 10 seconds. • Disconnect processor 60 pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Connect Breakout box to harness. Leave processor disconnected. • DVOM on 200 ohm scale. • Measure and record the resistance of injector Bank 1 between test Pin 37 and test Pin 58 at the Breakout box. • Measure and record the resistance of injector Bank 2 between test Pin 37 and test Pin 59 at the Breakout box. • Are both resistances between 3.5 and 5.0 ohms?	Yes ▶ No ▶	GO to HH6. GO to HH5.
HH5 ISOLATE FAULTY INJECTOR CIRCUIT		
• Key Off. • Breakout box installed. • Leave processor disconnected. • DVOM on 200 ohm scale. • Disconnect all injectors on suspect Bank. Measure the resistance of each injector by connecting one injector at a time, and reading resistance between test Pin 37 and 58 at the Breakout box for Bank 1 or test Pin 37 and 59 at the Breakout box for Bank 2. • Are all resistances between 15.0 and 19.0 ohms?	Yes ▶ No ▶	GO to HH6. SERVICE the harness/connectors on the suspect injector for opens or shorts. If OK, REPLACE injector. REPEAT Quick Test.

Fuel Control — 5.0L/7.5L EFI Truck

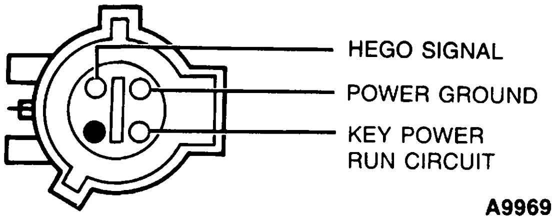
Pinpoint Test HH

TEST STEP	RESULT ▷	ACTION TO TAKE
HH6 INJECTOR DRIVER SIGNAL CHECK		
Requires standard non-powered 12-volt test lamp. o Key Off. o Breakout box installed. o Connect processor to Breakout box. o Connect test lamp between test Pin 37 and test Pin 58 at the Breakout box. o Crank or start engine. o Repeat above test between test Pin 37 and test Pin 59 at the Breakout box.	Dim glow at light on both tests ▷	GO to HH7.
	No light on one or both tests ▷	VERIFY 12-volt battery power at Pins 37 and 57. If OK, REPLACE processor. REPEAT Quick Test.
	Bright light on one or both tests ▷	CHECK circuits Bank 1 and Bank 2 for shorts to ground. If OK, REPLACE processor. REPEAT Quick Test.
HH7 INJECTOR BALANCE TEST		
o Connect tachometer to engine. Run engine at idle. o Disconnect and reconnect the injectors one at a time; note rpm drop for each injector. o Does each injector produce at least a 100 rpm momentary drop? **NOTE: ISC will attempt to reestablish rpm.**	Yes ▷	Fuel delivery OK. Problem is with area common to all cylinders, i.e.: Air/vacuum leak, fuel contamination, EGR.
	No ▷	REPLACE faulty injector. REPEAT Quick Test.

Fuel Control — 5.0L/7.5L EFI Truck

Pinpoint Test

HH

TEST STEP		RESULT ▶	ACTION TO TAKE
HH8	FUEL CONTROL — ALWAYS RICH: CODE 42 CHECK HEGO HARNESS FOR SHORT TO POWER		
	- Key Off, wait 10 seconds. - Disconnect vehicle harness at the HEGO sensor. - DVOM on 20 volt scale. - Key On. - Measure voltage between HEGO signal and ground at the HEGO harness connector.  **A9969-B** - Is voltage less than 0.5 volts?	Yes ▶ No ▶	GO to **HH9**. REPAIR short to key power in HEGO circuit. RERUN Quick Test.
HH9	CHECK HEGO FOR SHORT TO KEY POWER		
	- Key Off. - HEGO disconnected. - DVOM on 200,000 ohm scale. - Measure resistance between key power input and HEGO circuit at the HEGO sensor. - Is resistance less than 10,000 ohms?	Yes ▶ No ▶	REPLACE HEGO sensor. RERUN Quick Test. GO to **HH10**.

Fuel Control — 5.0L/7.5L EFI Truck

Pinpoint Test

HH

TEST STEP	RESULT ▷	ACTION TO TAKE
HH10 ATTEMPT TO GENERATE CODE 41		
o Key Off, wait 10 seconds. o NOTE: **Non-EEC areas could cause a code 42.** **Check for:** **— Fuel contaminated engine oil** **— Ignition caused misfire (fouled spark plug)** **— CANP problems** o Refer to illustration HH. o Disconnect vehicle harness at the HEGO sensor. Jumper (ground) the HEGO circuit at the HEGO sensor vehicle harness connector to the engine block. o Repeat Engine Running Self-Test. o Is service code 41 present?	Yes ▷	REMOVE jumper. GO to HH11.
	No ▷	REMOVE jumper. DISCONNECT processor connector. INSPECT for damage or corrosion. If OK, REPLACE processor. RERUN Quick Test.
HH11 CHECK MAP SENSOR		
NOTE: Due to the MAP sensor's influence on fuel control, there is a possibility that a code 42 could be a result of a MAP problem even though a code 22 is not present. The next 2 Pinpoint Test Steps will verify proper vacuum to the MAP sensor and the ability to hold vacuum. o Key Off, wait 10 seconds. o Disconnect vacuum line from MAP sensor. o Install vacuum pump to MAP sensor. o Apply 18 in.-Hg. (59 kPa) vacuum to MAP sensor. o Does MAP sensor hold vacuum?	Yes ▷	RELEASE vacuum. GO to HH12.
	No ▷	REPLACE MAP sensor. CONNECT vacuum line to MAP sensor. RERUN Quick Test.

Fuel Control — 5.0L/7.5L EFI Truck

Pinpoint Test

HH

TEST STEP	RESULT ▶	ACTION TO TAKE
HH12 CHECK FOR LOSS OF MAP VACUUM		
• Tee a vacuum gauge in the intake manifold vacuum line at the MAP sensor. • Start engine and note vacuum reading. • Key Off, wait 10 seconds. • Remove vacuum gauge and tee and reconnect vacuum line to MAP. • Tee in vacuum gauge at a different source of intake manifold vacuum. • Start engine and note vacuum reading. • Are vacuum readings within 1 in.-Hg. (3 kPa) of each other?	Yes ▶ No ▶	GO to **HH13**. INSPECT vacuum lines for leaks, holes, disconnections, kinks, blockage and proper routing. SERVICE as necessary.
HH13 EGO CHECK		
• Refer to illustration HH. • DVOM on 20V scale. • With HEGO sensor disconnected from the harness, connect a DVOM from HEGO sensor to engine ground. • Disconnect PCV hose. • Start engine and run at approximately 2000 rpm. Does the DVOM read less than 0.4V within 30 seconds?	Yes ▶ No ▶	HEGO sensor OK. GO to **HH1**. REPLACE HEGO sensor. RERUN Quick Test.
HH15 FUEL CONTROL — ALWAYS LEAN: CODE 41 VERIFICATION		
• Run vehicle at 2000 rpm for 2 minutes. • Key Off, wait 10 seconds. • Perform Engine Running Self-Test. • Is code 41 present?	Yes ▶ No ▶	GO to **HH16**. GO to **HH21**.

Fuel Control — 5.0L/7.5L EFI Truck

Pinpoint Test

HH

TEST STEP	RESULT ▷	ACTION TO TAKE
HH16 FUEL CONTROL — INDICATES LEAN 41		
NOTE: Vaccum/air leaks in non-EEC areas could cause a code 41. **Check for:** **— Leaking vacuum actuator (e.g.: A/C control motor)** **— Engine sealing** **— EGR system** **— PCV system** **— Lead contaminated HEGO sensor** o Key Off. DVOM on 20V scale. Disconnect HEGO sensor from vehicle harness. Connect DVOM to HEGO sensor and engine ground. o Disconnect and plug vacuum line to MAP sensor. o Apply 10 in.-Hg. (33 kPa) vacuum to MAP sensor. o Start the engine and run at approximately 2000 rpm. Does the DVOM read greater than 0.5V within 1 minute?	Yes ▷ No ▷	GO to **HH17**. REPLACE HEGO sensor. RECONNECT MAP vacuum line. RERUN Quick Test.
HH17 HARNESS CHECK HEGO CIRCUITS		
o Key Off. o Install Breakout box. Processor disconnected. o Measure resistance between test Pin 49 at the Breakout box and engine block ground and between HEGO circuit at the HEGO vehicle harness connector and test Pin 29 at the Breakout box. o Are both circuits less than 5 ohms?	Yes ▷ No ▷	GO to **HH18**. SERVICE/CORRECT as necessary circuit with greater than 5 ohms resistance. RECONNECT MAP vacuum line. RERUN Quick Test.
HH18 CHECK HEGO CIRCUIT FOR SHORT TO GROUND		
o Key Off. o HEGO disconnected. o Breakout box installed. Processor disconnected. o DVOM to 200,000 ohms range. o Measure resistance between test Pin 29 and test Pin 40 at the Breakout box. o Is resistance greater than 10,000 ohms?	Yes ▷ No ▷	GO to **HH19**. CORRECT cause of resistance to ground. RECONNECT MAP vacuum line. RERUN Quick Test.

Fuel Control — 5.0L/7.5L EFI Truck

Pinpoint Test

HH

TEST STEP	RESULT ▶	ACTION TO TAKE
HH19 CHECK HEGO SENSOR TO GROUND • Key Off. • HEGO disconnected. • DVOM on 200,000 ohm scale. • Measure resistance from power ground to HEGO signal at HEGO sensor. • Is resistance less than 10,000 ohms?	Yes ▶	REPLACE HEGO sensor. RECONNECT MAP vacuum line. RERUN Quick Test.
	No ▶	GO to HH20.
HH20 ATTEMPT TO ELIMINATE CODE 41 • Key Off. • Processor connected. • Reconnect HEGO sensor. • MAP vacuum line still disconnected and plugged. • Apply 10 in.-Hg. (33 kPa) vacuum to MAP sensor. • Start the engine and run at approximately 2000 rpm for 1 minute. Allow engine to return to idle. • Perform Engine Running Self-Test. • Is code 41 still present? **NOTE: Disregard any other code input at this time.**	Yes ▶	INSPECT for corrosion or damaged pins. If OK, REPLACE processor. RECONNECT MAP vacuum line. RERUN Quick Test.
	No ▶	RECONNECT MAP vacuum line. HEGO input circuit OK. GO to HH1 (basic fuel delivery).
HH21 CHECK HEATER ELEMENT RESISTANCE ON HEATED EGO • Key off, engine off. • DVOM on 200 ohm scale. • HEGO disconnected. • Measure resistance between run circuit and ground at the HEGO sensor. Refer to illustration HH. • Hot to warm resistance specification is 5 to 20 ohms. **NOTE: At room temperature, resistance specification is 2 to 5 ohms.** • Is resistance within specification?	Yes ▶	GO to HH22.
	No ▶	REPLACE HEGO sensor.

Fuel Control — 5.0L/7.5L EFI Truck

Pinpoint Test

HH

TEST STEP	RESULT ▶	ACTION TO TAKE
HH22 CHECK FOR POWER AT HEGO HARNESS CONNECTOR		
o Key on, engine off. o DVOM on 20V scale. o Connect positive lead to run circuit and negative lead to ground at HEGO vehicle harness connector. o Is voltage greater than 10.5V?	Yes ▶	HEGO sensor system OK. RECONNECT HEGO and GO to **HH1**.
	No ▶	GO to **HH23**.
HH23 CHECK CONTINUITY OF GROUND TO HEGO CONNECTOR		
o Key Off, wait 10 seconds. o DVOM on 200 ohm scale. o Measure resistance of power ground circuit from HEGO vehicle harness connector to battery ground. o Is resistance less than 5.0 ohms?	Yes ▶	SERVICE open in run circuit.
	No ▶	SERVICE open in power ground circuit.

Fuel Control – 5.0L/7.5L EFI Truck | Pinpoint Test | HH

HH90 CONTINUOUS TESTING: CODE 41

Code 41: Indicates that the HEGO circuit has not switched during closed loop fuel control.

NOTE: In this situation code 41 does not necessarily indicate a lean condition.

CLOSED LOOP — Fuel control under the influence of the HEGO sensor.

OPEN LOOP — Fuel control NOT under the influence of the HEGO sensor.

Before attempting to correct a continuous fuel control code 41, diagnose all other drive complaints first, eg., rough idle, misses, etc. in EEC Diagnostic By Symptom in the appropriate engine supplement.

NOTE: The fuel control code may help in this diagnosis.

Using the fuel control service code, isolate the cause of the fuel control problem.

Some areas to check are:

• Vacuum Circuits:	— Vacuum leaks/intake air leaks. — PCV System. — Engine sealing.
• HEGO Fuel Fouled:	Whenever an over-rich fuel condition has been experienced (fuel fouled spark plugs), make a thorough check of the ignition system. In the event the HEGO sensor is suspected of being fuel fouled (low output, slow response), run the vehicle at sustained high speeds (within legal limits) followed by a few hard accelerations. This will burn off HEGO contamination and restore proper HEGO operation.
• Ignition System:	Always in default spark (10 degrees). Refer to Quick Test Step 4.0.
• Improper Fueling:	Lead fouled HEGO sensor.
• Fuel Pressure:	Perform Pinpoint Test Step HH1 and HH2.

- If at this point, the drive concern (if any) is still present, perform Steps HH3 and HH7 only.

Fuel Pump Circuit — (Inertia Switch)

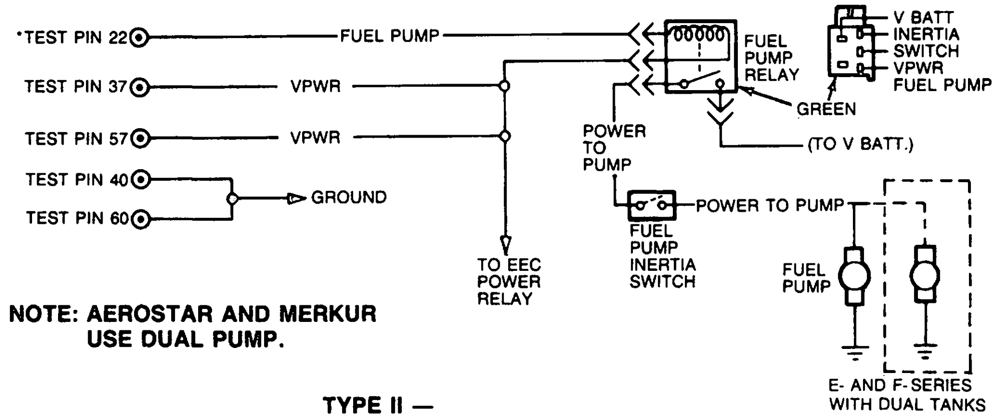
Pinpoint Test

J

J

TYPE I —

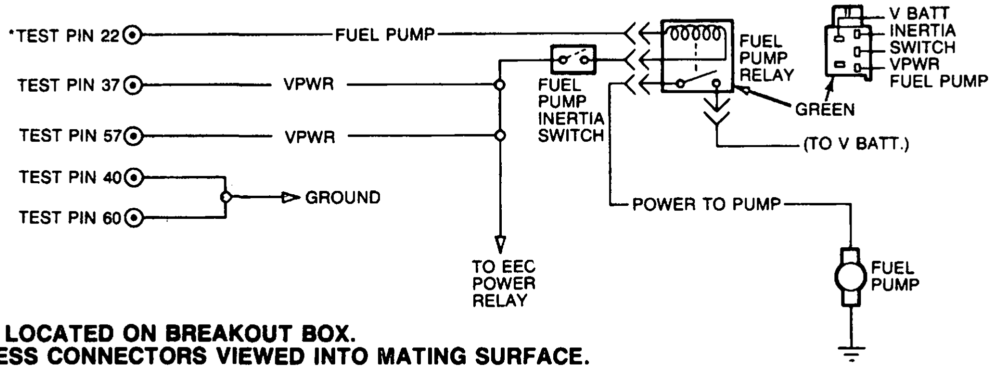
VEHICLE APPLICATION: LINCOLN TOWN CAR, FORD CROWN VICTORIA/MERCURY GRAND MARQUIS, MARK VII/CONTINENTAL,THUNDERBIRD/COUGAR, MUSTANG, RANGER, AEROSTAR AND MERKUR



NOTE: AEROSTAR AND MERKUR USE DUAL PUMP.

TYPE II —

VEHICLE APPLICATION: TEMPO/TOPAZ, ESCORT/LYNX, AND EXP



***TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.**

A9668-B

STOP-WARNING

You should enter this Pinpoint Test only when a service code 87 is received in Quick Test Step 3.0 or you are directed here from Pinpoint Test Step A22 or Diagnostics by Symptom in the Engine Supplement Section.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- o Fuel Lines
- o Fuel Filters
- o Throttle Body
- o Contaminated Fuel
- o Fuel Pump
- o Inertia Switch

This Pinpoint Test is intended to diagnose only the following:

- o Fuel Pump Relay
- o Harness Circuits: V Batt., V Power, F.P., Ground and Power to Pump(s)
- o Processor Assembly

Fuel Pump Circuit — (Inertia Switch)

Pinpoint Test

J

TEST STEP		RESULT ▶	ACTION TO TAKE
J1	NO FUEL PUMP PRESSURE		
	• Fuel pressure gauge installed. • To check if fuel pump runs, cycle key from Off to Run, repeat several times. (Do not enter start mode.) Fuel pump should run briefly each time the key enters Run.	Yes ▶	GO to Shop Manual, Group 24 electric fuel pump.
		No ▶	GO to J2.
J2	CHECK FOR V POWER TO PROCESSOR		
	• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box and reconnect processor. • Key On, engine Off. • DVOM on 20V scale. • Measure voltage between test Pin 37 and test Pin 40 at the Breakout box and between test Pin 57 and test Pin 60 at the breakout box.	Either voltage reading is less than 10.5V ▶	GO to B1.
		Both voltage readings are 10.5V or greater ▶	GO to J3.
J3	RESISTANCE CHECK OF FUEL PUMP INERTIA SWITCH		
	• Key Off, wait 10 seconds. • Leave Breakout box installed and processor connected. • Locate and disconnect fuel pump inertia switch. • DVOM on 200 ohm scale. • Measure the resistance of the fuel pump inertia switch.	Less than 5.0 ohms ▶	RECONNECT inertia switch and GO to J4.
		5.0 ohms or greater ▶	REPLACE or reset fuel pump inertia switch. RERUN Quick Test.
J4	POWER TO PUMP(S) CHECK		
	• Key On, engine Off. • Leave Breakout box installed and processor connected. • Locate fuel pump relay. • DVOM on 20V scale. • Measure voltage between chassis ground and power-to-pump(s) circuit at fuel pump relay during crank mode.	8.0V or greater during crank ▶	GO to J5.
		Less than 8.0V during crank ▶	GO to J6.

Fuel Pump Circuit — (Inertia Switch)

Pinpoint Test

J

TEST STEP	RESULT ▶	ACTION TO TAKE
J5 POWER AT FUEL PUMP(S) CHECK		
◎ Key On, engine Off. ◎ Leave Breakout box installed and processor connected. ◎ Locate fuel pump(s). ◎ DVOM on 20V scale. ◎ Measure voltage between chassis ground and power-to-pump(s) circuit at fuel pump during crank mode.	8.0V or greater during crank ▶ Less than 8.0V during crank ▶	GO to Shop Manual, Group 24 electric fuel pump. SERVICE open in power to the pump(s) circuit. RERUN Quick Test.
J6 FUEL PUMP CIRCUIT CHECK TO V BATT.		
◎ Key On, engine Off. ◎ Leave Breakout box installed and processor connected. ◎ Locate fuel pump relay. ◎ DVOM on 20V scale. ◎ Measure voltage between chassis ground and V Batt. at the fuel pump relay.	10.5V or greater ▶ Less than 10.5V ▶	GO to J7. SERVICE open in V Batt. between fuel pump relay and vehicle battery positive post. RERUN Quick Test.
J7 V POWER TO FUEL PUMP RELAY CHECK		
◎ Key On, engine Off. ◎ Leave Breakout box installed and processor connected. ◎ Locate fuel pump relay. ◎ DVOM on 20V scale. ◎ Measure voltage between chassis ground and V Power circuit at the fuel pump relay.	10.5V or greater ▶ Less than 10.5V ▶	GO to J8. VERIFY inertia switch is reset to On. If switch will not reset, REPLACE switch. If OK, SERVICE open in V Power circuit between the processor and the fuel pump relay. RERUN Quick Test.
J8 FUEL PUMP CIRCUIT CHECK CONTINUITY		
◎ Leave Breakout box installed and processor connected. ◎ Key Off, wait 10 seconds. ◎ DVOM on 200 ohm scale. ◎ Measure resistance between fuel pump circuit at the pump relay and test Pin 22 at the Breakout box.	Less than 5 ohms ▶ 5 ohms or greater ▶	GO to J9. SERVICE open in fuel pump circuit and RERUN Quick Test.

Fuel Pump Circuit — (Inertia Switch)

Pinpoint Test

J

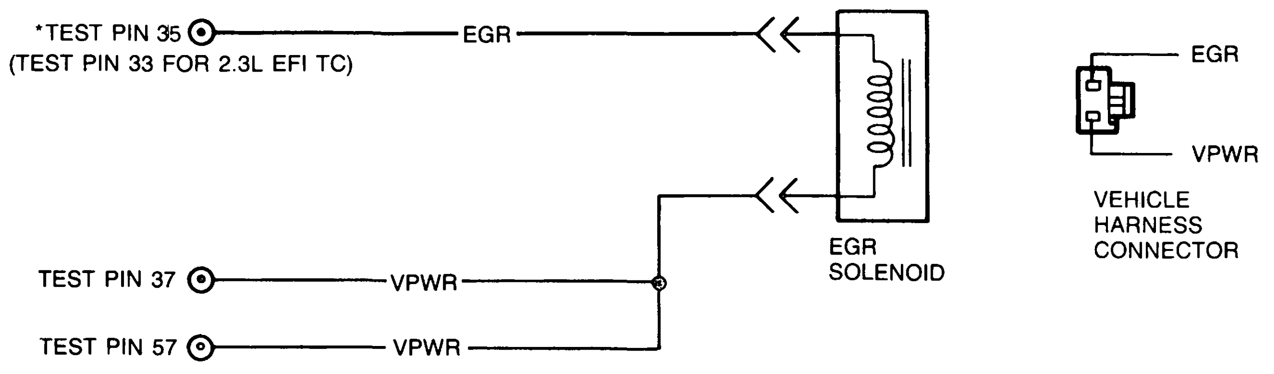
TEST STEP	RESULT ▶	ACTION TO TAKE
J9 CHECK FOR SHORT TO GROUND		
• Key Off. • Leave Breakout box installed and processor disconnected. • Fuel pump relay disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 22 and test Pins 40 and 60 at the Breakout box.	10,000 ohms or greater ▶	GO to J10.
	Less than 10,000 ohms ▶	SERVICE short in the fuel pump circuit. RERUN Quick Test.
J10 CHECK FOR SHORT TO POWER		
• Key Off, wait 10 seconds. • Leave Breakout box installed and disconnect processor. • Fuel pump relay disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 22 and test Pins 37 and 57 at the Breakout box.	10,000 ohms or greater ▶	RECONNECT fuel pump relay. GO to J11.
	Less than 10,000 ohms ▶	SERVICE short to power in the fuel pump circuit. RECONNECT processor, ATTEMPT to start vehicle. If vehicle fails to start, REPLACE processor. RERUN Quick Test.
J11 FINAL SYSTEM CHECK		
• Leave Breakout box installed and processor disconnected. • Connect jumper wire from test Pin 22 to test Pin 40 or 60 at the Breakout box. • DVOM on 20V scale. • Key On, engine Off. • Measure voltage between chassis ground and power-to-pump(s) circuit at fuel pump relay.	10.5V or greater ▶	REPLACE processor. RERUN Quick Test.
	Less than 10.5V ▶	REPLACE fuel pump relay. RECONNECT processor and RERUN Quick Test.
J15 FUEL PUMP RELAY CHECK		
• Key-Off. • Remove fuel pump relay. • Does fuel pump turn off?	Yes ▶	REPLACE fuel pump relay. RERUN Quick Test.
	No ▶	SERVICE short to power to pumps circuit.

EGR On/Off Control

Pinpoint Test

KA

KA



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9669-B

STOP-WARNING

You should enter this Pinpoint Test only when a service code 34 or 84 is received in Quick Test Step 3.0, 5.0 or when directed here from Diagnostic by Symptom in the Engine Supplement Section.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Air or Vacuum Leaks
- EGR Flow Restrictions
- EGR Value

NOTE: Code 34 may be the result of high volume exhaust vent system (reduces backpressure). If this is suspected, perform the test in a well-ventilated area without exhaust vent connected.

This Pinpoint Test is intended to diagnose only the following:

- Circuits: EGR and VPWR
- EGR Solenoid
- Presence of Manifold Vacuum
- Processor Assembly

EGR On/Off Control

Pinpoint Test

KA

TEST STEP		RESULT ▶	ACTION TO TAKE
KA1	ENTER OUTPUT STATE CHECK (REFER TO APPENDIX)		
	NOTE: Do not use STAR tester for this step, use a VOM/DVOM. • Key Off, wait 10 seconds. • DVOM on 20V scale. • Connect DVOM negative test lead to STO at the Self-Test connector and positive test lead to battery positive. • Jumper STI to signal return at the Self-Test connector. • Perform Key On Engine Off Self-Test until the completion of the Continuous Test Codes. • DVOM will indicate zero volts. • Depress and release the throttle. • Did DVOM reading change to a high voltage reading?	Yes ▶	REMAIN in Output State Check. GO to KA2.
		No ▶	DEPRESS throttle to WOT and release. If STO voltage does not go high, GO to Pinpoint Test Step Q40. Leave equipment hooked up.
KA2	CHECK EGR ON/OFF CONTROL SOLENOID ELECTRICAL OPERATION		
	• DVOM on 20V scale. • Connect DVOM positive test lead to VPWR circuit on EGR solenoid and negative test lead to EGR output circuit. • While observing DVOM, depress and release the throttle several times to cycle output On and Off. • Does EGR output cycle On and Off?	Yes ▶	GO to KA3.
		No ▶	REMOVE STI jumper. GO to KA5.
KA3	CHECK SOLENOID FOR VACUUM CYCLING		
	• Install vacuum pump to the solenoid vacuum supply port and install a vacuum gauge to the output port. Apply 6 in. Hg minimum. • While cycling outputs On and Off (by depressing and releasing throttle) observe the vacuum gauge at the output. **NOTE: Maintain vacuum at source.** • Does output port vacuum cycle On and Off?	Yes ▶	GO to KA4.
		No ▶	REPLACE solenoid. RERUN Quick Test.

EGR On/Off Control

Pinpoint Test

KA

TEST STEP	RESULT ▶	ACTION TO TAKE
KA4 CHECK MANIFOLD VACUUM LINES FOR BLOCKAGE OR LEAKS		
○ Vacuum lines disconnected at solenoid. ○ Start engine. ○ Check for vacuum. ○ Is vacuum present?	Yes ▶	EEC-IV system OK. REFER to Section 6.
	No ▶	SERVICE vacuum source blockage or leak. RERUN Quick Test.
KA5 MEASURE EGR SOLENOID RESISTANCE		
○ Key Off, wait 10 seconds. ○ DVOM on 200 ohm scale. ○ Disconnect EGR solenoid connector and measure solenoid resistance. ○ Is resistance between 65 and 110 ohms?	Yes ▶	GO to **KA6**.
	No ▶	REPLACE EGR solenoid. RERUN Quick Test.
KA6 CHECK VOLTAGE OF VPWR CIRCUIT		
○ Key On, Engine Off. ○ DVOM on 20V scale. ○ Measure voltage between VPWR circuit at the EGR solenoid vehicle harness connector and battery ground. ○ Is voltage greater than 10.5 volts?	Yes ▶	GO to **KA7**.
	No ▶	SERVICE harness open circuit. RERUN Quick Test.
KA7 CHECK CONTINUITY OF EGR CIRCUIT		
○ Key Off, wait 10 seconds. ○ Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. ○ Connect Breakout box to harness. Leave processor disconnected. ○ DVOM on 200 ohm scale. ○ Measure resistance between test Pin 35 (test Pin 33 for 2.3L EFI TC) at the Breakout box and EGR circuit at vehicle harness connector. ○ Is resistance less than 5 ohms?	Yes ▶	GO to **KA8**.
	No ▶	SERVICE open circuit. RERUN Quick Test.

EGR On/Off Control

Pinpoint Test

KA

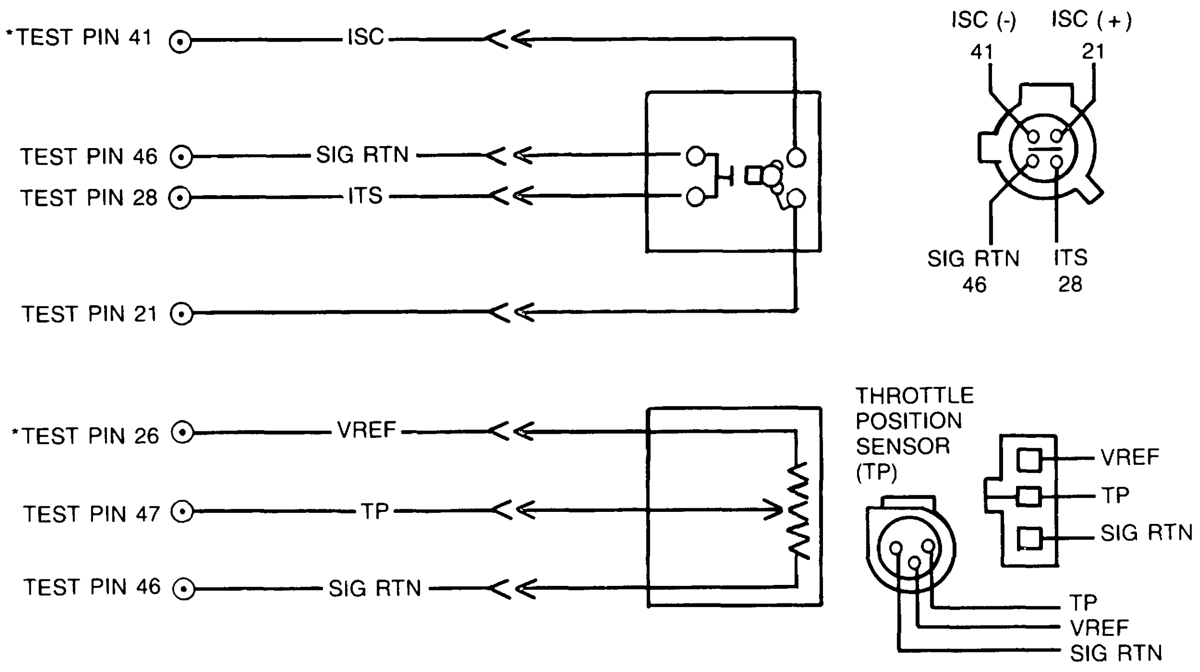
TEST STEP	RESULT ▶	ACTION TO TAKE
KA8 CHECK FOR SHORT TO GROUND		
• Key Off, wait 10 seconds. • Leave Breakout box installed and processor disconnected. • Disconnect EGR solenoid. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 35 (test Pin 33 for 2.3L EFI TC) and test Pins 40, 46 and 60 at the Breakout box. • Is resistance greater than 10,000 ohms?	Yes ▶ No ▶	GO to KA9. SERVICE short to ground. RERUN Quick Test.
KA9 CHECK FOR SHORT TO POWER		
• Key Off, wait 10 seconds. • DVOM on 200,000 ohm scale. • Leave Breakout box installed and processor disconnected. • EGR solenoid disconnected. • Measure resistance between test Pin 35 (test Pin 33 for 2.3L EFI TC) and test Pins 37 and 57 at the Breakout box. • Is resistance greater than 10,000 ohms?	Yes ▶ No ▶	REPLACE Processor. RERUN Quick Test. SERVICE short to power. RERUN Quick Test. If code is repeated, REPLACE processor.

DC Motor Idle Speed Control/Idle Tracking Switch and Throttle Position Sensor — 1.9L CFI and 2.3L (HSC) CFI

Pinpoint Test

KB

KB



***TEST PINS LOCATED ON THE BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9918-A

STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 12, 13, 23, 38, 53, 58, 63, 68, 71, 73 or 93 is received in Quick Test Step 3.0, 5.0, or 6.0 or when directed here from Diagnostics by Symptom in the Engine Supplement Section.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Anti-diesel speed set too high
- Basic engine
- Vacuum leaks
- Throttle sticking

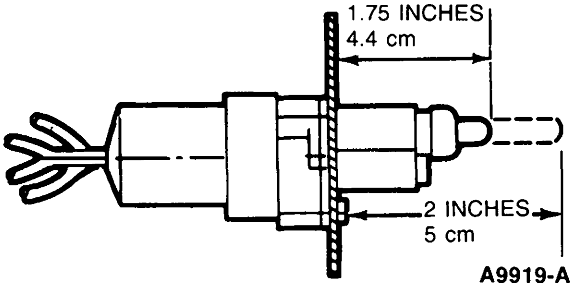
This Pinpoint Test is intended to diagnose only the following:

- DC motor
- Idle Tracking Switch
- Harness circuits ISC+, ISC−, ITS, TP, VREF, and, SIG RTN
- Throttle position sensor
- EEC-IV processor assembly

DC Motor Idle Speed Control/Idle Tracking Switch and Throttle Position Sensor — 1.9L CFI and 2.3L (HSC) CFI

Pinpoint Test

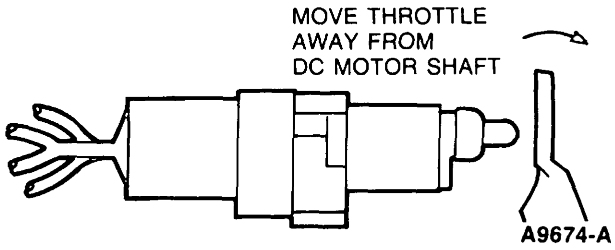
KB

TEST STEP	RESULT ▶	ACTION TO TAKE
KB1 CHECK DC MOTOR FOR PROPER OPERATION		
• Key Off, wait 10 seconds. • Disconnect harness from DC motor. • Jumper ISC+ circuit of DC motor to battery positive and ISC− circuit of DC motor to battery ground for 4 seconds. • Jumper ISC+ circuit of DC motor to battery ground and ISC− circuit of DC motor to battery positive for 4 seconds. • Does the DC motor shaft extend to greater than 2 inches (5 cm) and retract to less than 1.75 inches (4.4 cm) from mounting bracket (see below)?  A9919-A	Yes ▶ No ▶	GO to KB2. REPLACE DC MOTOR. RERUN Quick Test.
KB2 CHECK CONTINUITY OF ISC+ AND ISC− CIRCUITS		
• Key Off, wait 10 seconds. • Harness disconnected from DC motor. • Disconnect processor 60 pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Connect Breakout box. Leave processor disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 41 at the Breakout box and ISC− circuit at the vehicle harness connector and between test Pin 21 at the Breakout box and ISC+ circuit at the vehicle harness connector. • Are both resistances less than 5 ohms?	Yes ▶ No ▶	GO to KB3. SERVICE faulty circuit(s). RERUN Quick Test.

DC Motor Idle Speed Control/Idle Tracking Switch and Throttle Position Sensor — 1.9L CFI and 2.3L (HSC) CFI

Pinpoint Test

KB

TEST STEP		RESULT ▶	ACTION TO TAKE
KB3	CHECK FOR SHORTS TO GRND OF ISC+ AND ISC− CIRCUITS		
	• Key Off, wait 10 seconds. • Breakout box installed and processor disconnected. • Harness disconnected from DC motor. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 41 and test Pins 40, 46 and 60 at the Breakout box. • Measure resistance between test Pin 21 and test Pins 40, 46 and 60 at the Breakout box. • Are all resistances greater than 10,000 ohms?	Yes ▶ No ▶	GO to KB4. SERVICE faulty circuit(s). RERUN Quick Test.
KB4	CHECK FOR SHORTS TO PWR. OF ISC+ AND ISC− CIRCUITS		
	• Key On engine off. • Breakout box installed and processor disconnected. • Harness disconnected from DC motor. • DVOM on 20V scale. • Measure voltage between test Pin 41 and test Pin 40 and 60 at the Breakout box. • Measure voltage between test Pin 21 and test Pins 40 and 60 at the Breakout box. • Are all voltages less than 1 volt?	Yes ▶ No ▶	REPLACE processor. RERUN Quick Test. SERVICE faulty circuit(s). RERUN Quick Test.
KB5	CHECK FOR FULL DC MOTOR RETRACTION		
	• Key Off, wait 10 seconds. • Disconnect harness from DC motor. • Jumper, at the DC motor connector, ISC− circuit to battery positive and the ISC+ circuit to battery negative for 4 seconds. • Does the DC motor shaft retract away from the throttle lever as shown? 	Yes ▶ No ▶	GO to KB7. GO to KB6.

DC Motor Idle Speed Control/Idle Tracking Switch and Throttle Position Sensor — 1.9L CFI and 2.3L (HSC) CFI

Pinpoint Test

KB

TEST STEP	RESULT ▶	ACTION TO TAKE
KB6 MEASURE DC MOTOR RETRACTION • Key Off, wait 10 seconds. • Harness disconnected from DC motor. • DC motor fully retracted. • Measure the distance from the tip of the DC motor shaft to the mounting bracket. Refer to figure in step KB1. • Is the distance less than 1.75 inches (4.4 cm)?	Yes ▶	RECONNECT DC motor. GO to Section 4 for throttle stop adjustment procedure.
	No ▶	REPLACE DC motor. RERUN Quick Test.
KB7 CHECK IDLE TRACKING SWITCH STATE • Key Off, wait 10 seconds. • Harness disconnected from DC motor. • DC motor fully retracted. • DC motor shaft **NOT** touching the throttle lever. • DVOM on 200 ohm scale. • Measure resistance between ITS circuit and SIG RTN at the DC motor connector. • Is the resistance less than 5 ohms?	Yes ▶	GO to KB8.
	No ▶	REPLACE DC motor. RERUN Quick Test.
KB8 CHECK CONTINUITY OF ITS AND SIG RTN CIRCUITS • Key Off, wait 10 seconds. • Harness disconnected from DC motor. • Disconnect processor 60 pin connector and inspect for damaged pins, corrosion or loose wires. Service as necessary. • Connect Breakout box. Leave processor disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 46 at the Breakout box and SIG RTN circuit at the DC motor vehicle harness connector. • Measure resistance between test Pin 28 at the Breakout box and ITS circuit at the DC motor vehicle harness connector. • Are both resistances less than 5 ohms?	Yes ▶	RECONNECT DC motor. REPLACE processor. RERUN Quick Test.
	No ▶	RECONNECT DC motor. SERVICE faulty circuit(s) RERUN Quick Test.

DC Motor Idle Speed Control/Idle Tracking Switch and Throttle Position Sensor — 1.9L CFI and 2.3L (HSC) CFI

Pinpoint Test

KB

TEST STEP	RESULT ▶	ACTION TO TAKE
KB9 CHECK IDLE TRACKING SWITCH STATE		
o Key Off, wait 10 seconds. o Disconnect harness from DC motor. o DVOM on 200 ohm scale. o Measure resistance between ITS circuit and SIG RTN circuit at the DC motor connector. o Is the resistance greater than 5 ohms?	Yes ▶ No ▶	GO to KB10. REPLACE DC motor. RERUN Quick Test.
KB10 CHECK FOR SHORTS TO GRND OF THE ITS CIRCUIT		
o Key Off, wait 10 seconds. o Harness disconnected from DC motor. o Disconnect processor 60 pin connector and inspect for damaged pins, corrosion loose wires. Service as necessary. o Connect Breakout box. Leave processor disconnected. o Measure resistance between test Pin 28 and test Pins 40, 46 and 60 at the Breakout box. o Are all resistances greater than 10,000 ohms?	Yes ▶ No ▶	RECONNECT DC motor. REPLACE processor. RERUN Quick Test. RECONNECT DC motor. SERVICE faulty circuit(s). RERUN Quick Test.
KB11 CHECK THROTTLE LEVER AND LINKAGE		
o Key Off, wait 10 seconds. o Inspect throttle for freedom of movement to wide open throttle and for damaged or bent throttle lever. o Is throttle/throttle linkage functioning properly?	Yes ▶ No ▶	REPLACE DC motor. RERUN Quick Test. SERVICE as necessary. RERUN Quick Test.
KB12 CHECK THROTTLE PLATE FOR CLOSING		
o Run Key On Engine Off Self Test and disconnect DC motor after it is fully retracted. o Key Off, wait 10 seconds. o Remove air cleaner from throttle body. o Inspect throttle for freedom of movement and proper closure. o Does throttle move freely and close without obstruction?	Yes ▶ No ▶	RECONNECT DC motor. GO to KB13. SERVICE as necessary. RERUN Quick Test

DC Motor Idle Speed Control/Idle Tracking Switch and Throttle Position Sensor — 1.9L CFI and 2.3L (HSC) CFI

Pinpoint Test

KB

TEST STEP	RESULT ▶	ACTION TO TAKE
KB13 CHECK VOLTAGE OF VREF TO SIGNAL RETURN		
- Key Off, wait 10 seconds. - Disconnect TP vehicle harness connector at the throttle body. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. - DVOM on 20V scale. - Key On Engine Off. - Measure voltage between VREF and SIG RTN at the vehicle harness connector. - Is the voltage between 4 and 6 volts?	Yes ▶ No ▶	RECONNECT TP sensor. GO to KB14. GO to Pinpoint Test Step C1.
KB14 CHECK THROTTLE STOP RPM		
- Run Key On Engine Off Self Test and disconnect the DC motor after it has fully retracted and exit Self Test. - Start engine and verify that the throttle stop rpm is less than curb idle rpm. - Is the throttle stop set below the curb idle? - Reconnect DC motor.	Yes ▶ No ▶	REPLACE the TP sensor. RERUN Quick Test. GO to the adjustment procedure in Section 4. ADJUST throttle stop rpm. RERUN Quick Test.
KB15 GENERATE CODE 63		
- Key Off, wait 10 seconds. - Disconnect harness from the TP sensor at the throttle body. Inspect for damaged pins, corrosion and loose wires. Service as necessary. - Run Key On Engine Off Self Test and record codes. - Is code 63 present? - Ignore all other codes.	Yes ▶ No ▶	GO to KB16. GO to KB17.

DC Motor Idle Speed Control/Idle Tracking Switch and Throttle Position Sensor — 1.9L CFI and 2.3L (HSC) CFI

Pinpoint Test

KB

TEST STEP	RESULT ►	ACTION TO TAKE
KB16 CHECK VOLTAGE VREF TO SIG RTN o Key Off, wait 10 seconds. o Harness disconnected from TP sensor at throttle body. o DVOM on 20V scale. o Key On Engine Off. o Measure voltage between VREF and SIG RTN at the TP vehicle harness connector. o Is the voltage between 4 and 6 volts?	Yes ►	REPLACE the TP sensor. RERUN Quick Test.
	No ►	GO to Pinpoint Test Step C1 .
KB17 CHECK TP SIGNAL FOR SHORT TO POWER o Key Off, wait 10 seconds. o Harness disconnected from TP sensor. o DVOM on 200,000 ohm scale. o Disconnect the processor 60 pin connector and inspect for damaged pins, corrosion and loose wires. Service as necessary. o Install Breakout box. Leave processor disconnected. o Measure resistance between test Pin 47 and test Pins 26 and 57 at the Breakout box. o Are both resistances 10,000 ohms or greater?	Yes ►	REPLACE processor. RERUN Quick Test.
	No ►	SERVICE faulty circuit(s). RERUN Quick Test.
KB18 GENERATE CODE 53 o Key Off, wait 10 seconds. o Disconnect harness from the TP sensor at the throttle body. Inspect for damaged pins, corrosion and loose wires. Service as necessary. o Jumper VREF to TP signal at the vehicle harness connector. o Run Key On Engine Off Self Test. **NOTE: If no codes are generated, immediately remove jumper and go directly to KB21.** o Is code 53 present? o Ignore all other codes at this time.	Yes ►	REPLACE TP sensor. RERUN Quick Test.
	No ►	GO to KB19 .

DC Motor Idle Speed Control/Idle Tracking Switch and Throttle Position Sensor — 1.9L CFI and 2.3L (HSC) CFI

Pinpoint Test

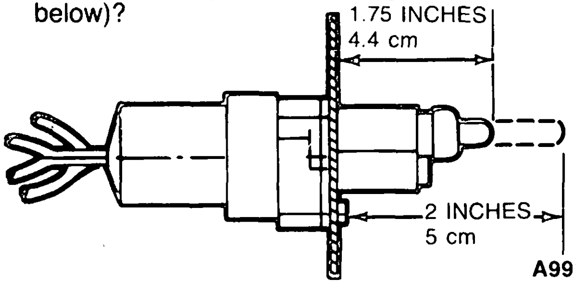
KB

TEST STEP	RESULT ▶	ACTION TO TAKE
KB19 CHECK VOLTAGE VREF TO SIG RTN		
• Key Off, wait 10 seconds. • Harness disconnected from TP sensor at throttle body. • DVOM on 20V scale. • Key On Engine Off. • Measure voltage between VREF and SIG RTN at the TP vehicle harness connector. • Is the voltage between 4 and 6 volts?	Yes ▶ No ▶	GO to KB20. GO to Pinpoint Test Step C1.
KB20 CHECK CONTINUITY OF TP CIRCUIT		
• Key Off, wait 10 seconds. • Harness disconnected from TP sensor at throttle body. • DVOM on 200 ohm scale. • Disconnect the processor 60 pin connector and inspect for damaged pins, corrosion and loose wires. Service as necessary. • Install Breakout box. Leave processor disconnected. • Measure resistance between TP signal at the vehicle harness connector and test Pin 47 at the Breakout box. • Is resistance less than 5 ohms?	Yes ▶ No ▶	GO to KB21. SERVICE faulty circuit(s). RECONNECT harness to TP sensor. RERUN Quick Test.
KB21 CHECK TP SIGNAL FOR SHORTS TO GROUND		
• Key Off, wait 10 seconds. • Harness disconnected from TP sensor at throttle body. • Breakout box installed. • DVOM on 200,000 ohm scale. • Measure resistance between TP signal at TP vehicle harness connector and test Pins 40, 46 and 60 at the Breakout box. • Are all resistances greater than 10,000 ohms?	Yes ▶ No ▶	REPLACE processor. RECONNECT TP sensor. RERUN Quick Test. SERVICE faulty circuit(s). RERUN Quick Test.

DC Motor Idle Speed Control/Idle Tracking Switch and Throttle Position Sensor — 1.9L CFI and 2.3L (HSC) CFI

Pinpoint Test

KB

TEST STEP	RESULT ▶	ACTION TO TAKE
KB22 SERVICE CODE 73		
o RERUN Key On Engine Off Self Test. o Is code 73 still present?	Yes ▶	REPLACE TP sensor. RERUN Quick Test.
	No ▶	SERVICE other codes.
KB23 CHECK FOR CODES THAT COULD CAUSE CODE 12		
o Are service codes 31, 32, 34, 35, 41, or 58 present in Engine Running Self Test?	Yes ▶	SERVICE these codes first. GO to Quick Test Step 5.0C for direction.
	No ▶	GO to **KB24**.
KB24 CHECK FOR STICKING THROTTLE LINKAGE		
o Check the throttle plates and/or linkage for sticking or binding. o Check speed control linkage for proper adjustment. o Does throttle open and close properly?	Yes ▶	GO to **KB25**.
	No ▶	SERVICE as necessary. RERUN Quick Test.
KB25 CHECK DC MOTOR FOR PROPER OPERATION		
o Key Off, wait 10 seconds. o Disconnect harness from DC motor. o Jumper ISC+ circuit of DC motor to battery positive and ISC− circuit of DC motor to battery ground for 4 seconds. o Jumper ISC+ circuit of DC motor to battery ground and ISC− circuit of DC motor to battery positive for 4 seconds. o Does the DC motor shaft extend to greater than 2 inches (5 cm) and retract to less than 1.75 inches (4.4 cm) from mounting bracket (see below)?	Yes ▶	REPLACE processor. RERUN Quick Test.
 A9919-A	No ▶	REPLACE DC MOTOR. RERUN Quick Test.

DC Motor Idle Speed Control/Idle Tracking Switch and Throttle Position Sensor — 1.9L CFI and 2.3L (HSC) CFI

Pinpoint Test

KB

TEST STEP	RESULT ▶	ACTION TO TAKE
KB26 CHECK FOR ERRATIC IDLE		
• Prepare system for normal engine operation. • Deactivate Self Test. • A/C off. • Run engine for 3 minutes alternating between 30 second idles and 5 second part throttle modes. • Is the idle erratic at the end of the three minute idle/part throttle test?	Yes ▶	CHECK for • Vacuum leaks • Code 22 • Code 31, 32, 34 or 35 • Code 41 • Code 58 SERVICE above codes before continuing.
	No ▶	GO to **KB27**.
KB27 CHECK FOR PROPER OPERATION OF THROTTLE		
• Inspect the throttle plates and/or linkage for proper function. • Does the throttle open and close properly?	Yes ▶	REPLACE DC motor. RERUN Quick Test.
	No ▶	SERVICE as necessary. RERUN Quick Test.

DC Motor Idle Speed Control/Idle Tracking Switch and Throttle Position Sensor — 1.9L CFI and 2.3L (HSC) CFI

Pinpoint Test

KB

KB90 CONTINUOUS MEMORY CODE 13

A Continuous Memory Code 13 indicates that sometime in the last 40 warm-up cycles the TP sensor rotation did not follow the reaction of the DC motor when idle speed control was in a dashpot mode. This condition may be caused by:

- The DC motor sticking at part throttle.
- An open in the ITS circuit which, when coupled with other inputs to the processor, causes the EEC-IV system to falsely enter 'dashpot mode'.
- The TP sensor sticking at part throttle.

Each of these areas may generate Key On Engine Off (KOEO) or other continuous memory codes. Therefore, if a repair has been made for KOEO code 13 or 58, the continuous memory code 13 can be considered serviced and erased from memory. If a Continuous Memory Code 38 is present along with the Continuous Memory Code 13, service the 38 first.

If these other codes were not present make the following checks:

- Refer to KB1 and check for FULL travel of the DC motor shaft. Replace the DC motor if full travel is not possible. Leave the motor fully retracted.
- With the DC motor fully retracted and the ITS not touching the throttle lever (ITS closed circuit) check for an intermittent open in the ITS circuit. Turn the ignition key off and install the Breakout box. Make the necessary connector/pin inspections. With the DVOM on the 200 ohm scale, monitor between test Pins 28 and 46 while tapping, wiggling, bending, etc. the DC motor connector and harness.

  DO NOT PUSH IN THE IDLE TRACKING SWITCH.

  The DVOM will change from less than 5 ohms to greater than 5 ohms if an open circuit is created. Service as necessary.
- Check for a sticking TP sensor by monitoring TP voltage while moving the throttle from a wide open position to a closed throttle position. To do this it is necessary to install the Breakout box. Make the necessary connector/pin inspections. It is also necessary to fully retract the shaft of the DC motor by placing a jumper between test Pins 41 and 57. When the motor has fully retracted, disconnect it at the harness and remove the jumper wire from the Breakout box. With the ignition key on and the DVOM on the 20 volt scale, slowly move the throttle wide open to closed throttle. The voltage should move from more than 4 volts to less than 1.5 volts. If the TP sensor hangs up in midrange replace it, otherwise no service should be made.

DC Motor Idle Speed Control/Idle Tracking Switch and Throttle Position Sensor — 1.9L CFI and 2.3L (HSC) CFI

Pinpoint Test

KB

KB91 CONTINUOUS MEMORY CODE 38

A Continuous Memory Code 38 indicates that in the last 40 warm-up cycles the Idle Tracking Switch was open (ITS touching the throttle) when the throttle angle was greater than the MAX extension of the DC motor shaft. This could be caused by:

- An open (either intermittent or hard fault) in the ITS circuit.
- Idle Tracking Switch stuck open (pushed in position).

Either of these conditions may cause a code 58 to appear in Key On Engine Off (KOEO). If a repair has been made for a KOEO code 58, the Continuous Memory Code 38 can be considered serviced and erased from memory.

If KOEO code 58 was not present the following checks can be made:

- With the DC motor fully retracted and the ITS not touching the throttle lever (ITS closed circuit) check for an intermittent open in the ITS circuit. Turn the ignition key off and install the Breakout box. Make the necessary connector/pin inspections. With the DVOM on the 200 ohm scale, monitor between Test Pins 28 and 46 while tapping, wiggling, bending, etc. the DC motor connector and harness.

  DO NOT PUSH IN THE IDLE TRACKING SWITCH.

  The DVOM will change from less than 5 ohms to greater than 5 ohms if an open circuit is created. Service as necessary. If an open circuit cannot be created, no repair should be made.

KB92 CONTINUOUS MEMORY CODE 71

A Continuous Memory Code 71 indicates that sometime in the last 40 warm-up cycles the Idle Tracking Switch was closed (ITS not touching the throttle lever) when the DC motor was in "preposition" — [after the engine has been running and the ignition key is turned off the DC motor fully retracts and then extends to a predetermined position for the next start-up]. This can be caused by:

- The ITS circuit shorted to ground or Signal Return (intermittent or hard fault).
- ITS stuck closed (ITS **NOT** in the pushed in position).

Either of these conditions may cause a Key On Engine Off (KOEO) code 68. If a repair has been made for KOEO code 68, the Continuous Memory Code 71 can be considered serviced and erased from memory.

If KOEO 68 was not present make the following checks:

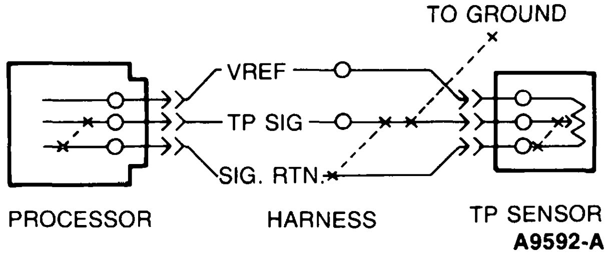
- Check the ITS circuit for an intermittent short to ground or Signal Return. Turn the ignition key off. Enter the KOEO Continuous Monitor Mode per Quick Test Step 6.0B. Systematically tap, wiggle, or bend the harness while looking for an indication of a fault. If a fault is created, service as necessary, otherwise no repair should be made.

NOTE: Due to the nature of this Test Step, Code 71 will not reappear in memory if a fault is found.

DC Motor Idle Speed Control/Idle Tracking Switch and Throttle Position Sensor — 1.9L CFI and 2.3L (HSC)

Pinpoint Test

KB

TEST STEP	RESULT ▶	ACTION TO TAKE
KB93 CONTINUOUS TEST SERVICE CODE 53: EXERCISE TP SENSOR		
o Using continuous monitor mode, observe VOM or STAR LED for indication of a fault while performing the following: o Move throttle slowly to WOT position. o Release throttle slowly to closed position and lightly tap on TP sensor (simulate road shock). o Wiggle TP harness connector. o Is a fault indicated?  TO GROUND VREF TP SIG SIG. RTN. PROCESSOR HARNESS TP SENSOR A9592-A	Yes ▶ No ▶	GO to KB94. GO to KB95.
KB94 MEASURE THROTTLE POSITION SIGNAL VOLTAGE WHILE EXERCISING TP SENSOR		
o Key Off, wait 10 seconds. o Disconnect processor 60 Pin connector and inspect for damaged pins, corrision, loose wires. Service as necessary. o Install Breakout box and reconnect processor. o VOM or STAR LED still connected to STO as in previous step. o Connect a DVOM from test Pin 47 to test Pin 46. o DVOM on 20V scale. o Key On Engine Off. o While observing DVOM, repeat Step KB93. o Does the fault occur below 4.25V?	Yes ▶ No ▶	DISCONNECT and INSPECT connectors. If connector and terminals are good, REPLACE TP sensor, REFER to Shop Manual Group 24 and RERUN Quick Test. Throttle position sensor overtravel may have caused the continuous code 53. Sensor service is not required. To verify harness integrity, GO to KB95.

DC Motor Idle Speed Control/Idle Tracking Switch and Throttle Position Sensor — 1.9L CFI and 2.3L (HSC)

Pinpoint Test

KB

TEST STEP	RESULT ▶	ACTION TO TAKE
KB95 CHECK EEC-IV HARNESS		
• Observe VOM or STAR LED for a fault indication while performing the following: • Referring to the illustration in Step DH90, grasp the harness close to the sensor connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. • Is a fault indicated?	Yes ▶	ISOLATE fault and make necessary repairs. REFER to appropriate figure. RERUN Quick Test.
	No ▶	GO to **KB96**.
KB96 CHECK PROCESSOR AND HARNESS CONNECTORS		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector. • Inspect both connectors and connector terminals for obvious damage or faults. • Are connectors and terminals OK?	Yes ▶	Unable to duplicate fault at this time. Continuous code 53 testing complete.
	No ▶	SERVICE as necessary. REPEAT Quick Test.
KB97 CONTINUOUS TEST SERVICE CODES 23 OR 63 EXERCISE TP SENSOR		
• Using continuous monitor mode, observe VOM or STAR LED for indication of a fault while performing the following: • Move throttle slowly to WOT position. • Release throttle slowly to closed condition. • Lightly tap on TP sensor (simulate road shock). • Wiggle TP harness connector. • Is a fault indicated?	Yes ▶	DISCONNECT and INSPECT connectors. If connector and terminals are good, REPLACE TP sensor, REFER to Shop Manual Group 24 and RERUN Quick Test.
	No ▶	GO to **KB98**.

DC Motor Idle Speed Control/Idle Tracking Switch and Throttle Position Sensor — 1.9L CFI and 2.3L (HSC)

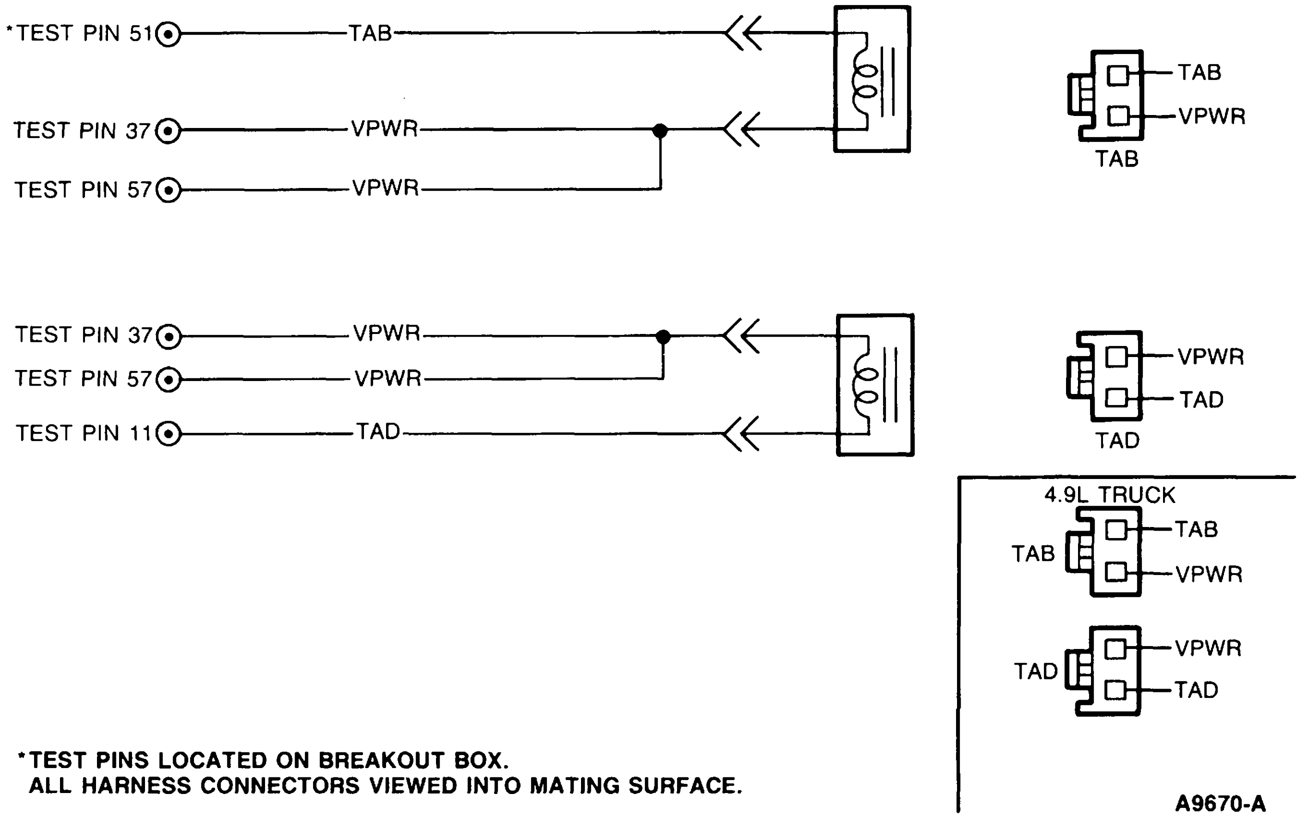
Pinpoint Test

KB

TEST STEP	RESULT ▶	ACTION TO TAKE
KB98 CHECK EEC-IV HARNESS		
o Observe VOM or STAR LED for a fault indication while performing the following: o Referring to the illustration in Step DH94, grasp the harness close to the sensor connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. o Is a fault indicated?	Yes ▶	ISOLATE fault and make necessary repairs. REFER to appropriate figure. RERUN Quick Test.
	No ▶	GO to KB99.
KB99 CHECK PROCESSOR AND HARNESS CONNECTORS		
o Key Off, wait 10 seconds. o Disconnect processor 60 Pin connector. o Inspect both connectors and connector terminals for obvious damage or faults. o Are connectors and terminals OK?	Yes ▶	Unable to duplicate fault at this time. Continuous code 63 testing complete.
	No ▶	SERVICE as necessary. REPEAT Quick Test.

Air Management System | Pinpoint Test | KC

KC



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

STOP-WARNING

You should enter this Pinpoint Test only when a service code 44, 45, 46, 94, 95, 96, 81 or 82 is received in Quick Test Step 3.0 or 5.0.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Thermactor System
  - Belt
  - Pump
  - Valve

This Pinpoint Test is intended to diagnose only the following:

- TAB and TAD Solenoid Valve Assemblies
- Harness Circuits: TAB, TAD and VPWR
- Vacuum Supply
- Processor Assembly

Air Management System

Pinpoint Test

KC

TEST STEP		RESULT ▶	ACTION TO TAKE
KC1	SERVICE CODES 44 (94), 45 (95) AND 46 (96): VERIFY VACUUM LINE ROUTING		
	⊙ Verify proper vacuum line routing to the TAB/TAD solenoids and to the bypass diverter valve. Refer to VECI decal. ⊙ Check for kinked or blocked vacuum lines. ⊙ Check for kinked or blocked air hoses. ⊙ Check for disconnected vacuum lines. ⊙ Are visual checks satisfactory?	No ▶	SERVICE routing or faults. RERUN Quick Test.
		Yes ▶	Service code 44 (94), GO to KC4. Service code 45 (95), GO to KC2. Service code 46 (96), GO to KC3.
KC2	ATTEMPT TO ELIMINATE SERVICE CODE 45 (95) (TAD ONLY)		
	⊙ Disconnect vacuum line on diverter valve and cap vacuum line. ⊙ Key Off, wait 10 seconds. ⊙ Repeat Engine Running Self-Test and record service codes. ⊙ Is code 45 (95) present?	Yes ▶	EEC-IV system OK. REFER to Section 3 for diverter valve or check valve diagnostics.
		No ▶	GO to KC4.
KC3	ATTEMPT TO ELIMINATE SERVICE CODE 46 (96) (TAB ONLY)		
	⊙ Disconnect vacuum line on bypass valve and cap vacuum line. ⊙ Key Off, wait 10 seconds. ⊙ Repeat Engine Running Self-Test and record codes. ⊙ Is code 46 (96) present?	Yes ▶	EEC-IV system OK. REFER to Section 3 for bypass valve diagnostics.
		No ▶	GO to KC4.

Air Management System | Pinpoint Test | KC

TEST STEP	RESULT ▶	ACTION TO TAKE
KC4 ENTER OUTPUT STATE CHECK (REFER TO APPENDIX)		
NOTE: Do not use STAR tester for this Step, use a VOM/DVOM. • Key Off, wait 10 seconds. • DVOM on 20V scale. • Connect DVOM negative test lead to STO circuit at the Self-Test connector and positive test lead to battery positive. • Jumper STI circuit to signal return at the Self-Test connector. • Perform Key On, Engine Off Self-Test until the completion of the Continuous Test Codes. • DVOM will indicate zero volts when Test is complete. • Depress and release the throttle. • Did DVOM reading change to a high voltage reading?	Yes ▶	REMAIN in Output State Check. GO to KC5.
	No ▶	DEPRESS throttle to WOT and RELEASE. If STO voltage does not go high, GO to Pinpoint Test Step Q40. Leave equipment hooked up.
KC5 CHECK TAB/TAD SOLENOID ELECTRICAL OPERATION		
• DVOM on 20V scale. • Reconnect DVOM positive test lead to VPWR circuit on TAB solenoid and negative test lead to TAB circuit on TAB solenoid. • While observing DVOM depress and release the throttle several times (to cycle output On and Off). • Repeat for TAD solenoid. Connect positive test lead to VPWR circuit on TAD solenoid and negative test lead to TAD circuit on TAD solenoid. • Solenoids cycle On and Off.	Both outputs cycle On and Off ▶	GO to KC6.
	Either output does not cycle On and Off ▶	REMOVE jumper. GO to KC8.
KC6 CHECK TAB/TAD SOLENOID FOR VACUUM CYCLING		
• Install vacuum pump to the TAB solenoid vacuum supply port and install a vacuum gauge to the output port. • While cycling outputs On and Off (by depressing and releasing throttle), observe the vacuum gauge at the output. **NOTE: Maintain vacuum at source.** • Repeat for TAD solenoid. Connect vacuum pump to the TAD solenoid vacuum supply port and connect a vacuum gauge to the output port. • Cycle output On and Off.	Both vacuum outputs cycle On and Off ▶	GO to KC7.
	Either vacuum output does not cycle On and Off ▶	REPLACE solenoid assembly. RERUN Quick Test.

Air Management System

Pinpoint Test

KC

TEST STEP	RESULT ▶	ACTION TO TAKE
KC7 CHECK MANIFOLD VACUUM LINES FOR BLOCKAGE OR LEAKS		
○ Vacuum lines disconnected at TAD/TAB solenoids. ○ Start engine. ○ Check for vacuum. ○ Is vacuum present at the solenoid?	Yes ▶	EEC-IV system OK. REFER to Section 3 for Thermactor valve and air pump diagnostics.
	No ▶	SERVICE vacuum source blockage or leak. RERUN Quick Test.
KC8 MEASURE TAB/TAD SOLENOID RESISTANCE		
○ Key Off, wait 10 seconds. ○ DVOM on 200 ohm scale. ○ Disconnect TAB solenoid connector and measure solenoid resistance. ○ Disconnect TAD solenoid connector and measure solenoid resistance. ○ Are both solenoid resistances between 50 and 100 ohms?	Yes ▶	CONNECT TAB/TAD solenoids. GO to **KC9.**.
	No ▶	REPLACE TAB/TAD solenoid assembly. RERUN Quick Test.
KC9 CHECK VOLTAGE OF VPWR CIRCUIT		
○ Key On, engine Off. ○ DVOM on 20V scale. ○ Measure voltage between TAB solenoid VPWR circuit and battery ground. ○ Repeat for TAD solenoid. ○ Are both voltage readings 10.5 volts or greater?	Yes ▶	GO to **KC10**.
	No ▶	SERVICE harness circuit open. RERUN Quick Test.

Air Management System | Pinpoint Test | KC

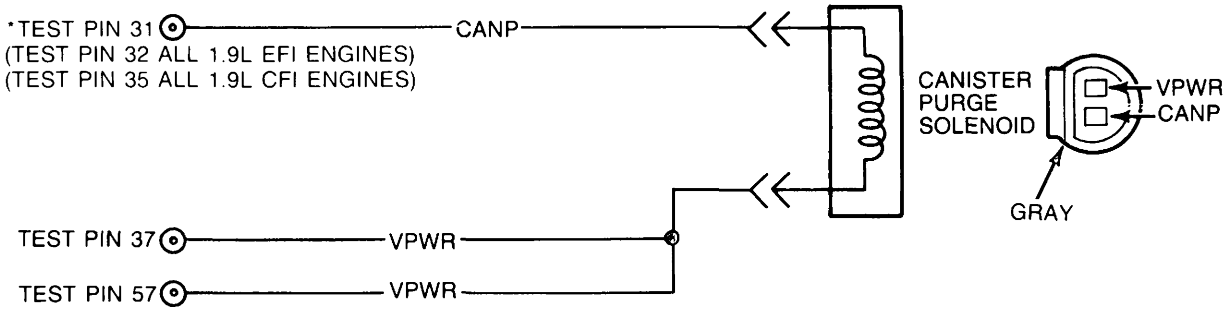
TEST STEP	RESULT ▶	ACTION TO TAKE
KC10 CHECK CONTINUITY OF TAB AND TAD CIRCUITS		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Connect Breakout box to harness. Leave processor disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 51 at Breakout box and TAB circuit at vehicle harness connector. • Measure resistance between test Pin 11 at the Breakout box and TAD circuit at vehicle harness connector. • Are both TAD and TAB circuits resistance 5 ohms or less?	Yes ▶ No ▶	GO to **KC11**. SERVICE harness open circuit. RERUN Quick Test.
KC11 CHECK FOR SHORT TO GROUND		
• Key Off, wait 10 seconds. • DVOM on 200,000 ohm. • Leave Breakout box installed and processor disconnected. • Disconnect TAB/TAD solenoids. • Measure resistance between test Pin 51 and test Pins 40, 46 and 60 and between test Pin 11 and test Pins 40, 46 and 60 at the Breakout box. • Are all resistance readings 10,000 ohms or greater?	Yes ▶ No ▶	GO to **KC12**. SERVICE short to ground. REMOVE Breakout box. RECONNECT harness to processor. RERUN Quick Test.
KC12 CHECK FOR SHORT TO POWER		
• Key Off, wait 10 seconds. • DVOM on 200,000 ohm scale. • Leave Breakout box installed and processor disconnected. • TAB/TAD solenoids disconnected. • Measure resistance between test Pin 51 and test Pins 37 and 57, and between test Pin 11 and test Pins 37 and 57 at the Breakout box. • Are all resistance readings 10,000 ohms or greater?	Yes ▶ No ▶	REPLACE processor. RERUN Quick Test. SERVICE short to power. RERUN Quick Test. If code is present, REPLACE processor.

Canister Purge (CANP)

Pinpoint Test

KD

KD



*TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9671-B

STOP-WARNING

You should enter this Pinpoint Test only when a service code 85 is received in Quick Test Step 3.0 or when you are directed here from a fuel control Pinpoint Test and Diagnostics by Symptom in the Engine Supplement Section.

This Pinpoint Test is intended to diagnose only the following:

- Harness Circuits: CANP and VPWR
- Processor Assembly

Canister Purge (CANP) | Pinpoint Test | KD

TEST STEP	RESULT ▶	ACTION TO TAKE
KD1 ENTER OUTPUT STATE CHECK (REFER TO APPENDIX)		
NOTE: Do not use STAR tester for this step, use VOM/DVOM. • Key Off, wait 10 seconds. • DVOM on 20V scale. • Connect DVOM negative test lead to STO circuit at Self-Test connector and positive test lead to battery positive. • Jumper STI circuit to signal return at the Self-Test connector. • Perform Key On, Engine Off Self-Test until the completion of the Continuous Test Codes. • DVOM will indicate zero volts when test is completed. • Depress and release the throttle. • Did DVOM reading change to a high voltage reading?	Yes ▶ No ▶	REMAIN in Output State Check. GO to KD2. DEPRESS throttle to WOT and release. If STO voltage does not go high, GO to Pinpoint Test Step Q40. Leave equipment hooked up.
KD2 CHECK CANISTER PURGE (CANP) SOLENOID ELECTRICAL OPERATION		
• DVOM on 20V scale. • Disconnect CANP solenoid. • Connect DVOM positive test lead to VPWR circuit and negative test lead to CANP output circuit on the vehicle harness connector. • While observing DVOM depress and release the throttle several times (to cycle output On and Off). • CANP circuit cycles On and Off?	Yes ▶ No ▶	GO to KD3. REMOVE jumper. GO to KD6.
KD3 CHECK CANISTER PURGE SOLENOID FOR HOLDING VACUUM		
• Key On. • CANP solenoid disconnected. • Disconnect vacuum hose at canister purge solenoid on PCV side. • Apply 16 in. Hg to CANP solenoid. • Does CANP solenoid hold vacuum for 20 seconds?	Yes ▶ No ▶	Leave vacuum pump setup in place. GO to KD4. REPLACE CANP solenoid. RERUN Quick Test. If symptom is still present, GO to Section 3, Carbon Canister.

Canister Purge (CANP)

Pinpoint Test

KD

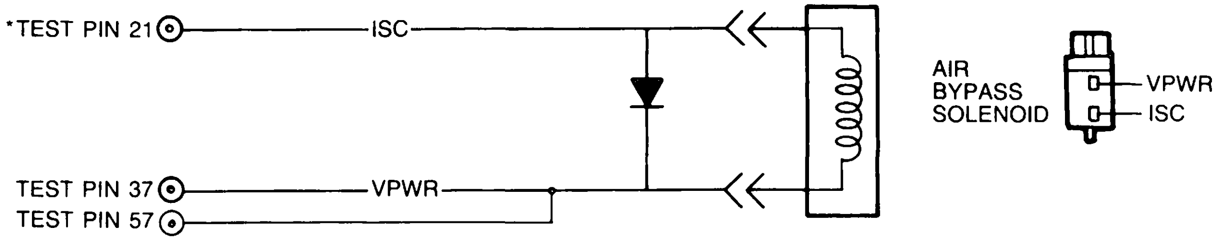
TEST STEP		RESULT ▶	ACTION TO TAKE
KD4	CHECK CANISTER PURGE SOLENOID FOR MECHANICAL OPERATION		
• Still in Output State Check. • CANP circuit Off (no voltage). • Reconnect CANP solenoid connector. • Apply 16 in.-Hg. to CANP solenoid as in KD3. • Depress and release throttle. • Is vacuum released?		Yes ▶	REMOVE Jumper from STI to signal return. GO to **KD5**.
		No ▶	REPLACE CANP solenoid. REPEAT Quick Test.
KD5	CHECK FOR VACUUM TO CANISTER PURGE SOLENOID		
• Disconnect vacuum hose at canister purge solenoid at PCV side. • Start engine. • Is vacuum present at engine vacuum hose?		Yes ▶	EEC-IV system OK. REFER to Shop Manual, Group 24.
		No ▶	CHECK vacuum line for proper routing, kinks or blockage. If OK, REFER to Shop Manual, Group 21 for probable subjects affecting engine vacuum.
KD6	MEASURE CANP SOLENOID RESISTANCE		
• Key Off, wait 10 seconds. • DVOM on 200 ohm scale. • Disconnect CANP solenoid connector and measure solenoid resistance. • Is resistance between 40 and 90 ohms?		Yes ▶	GO to **KD7**.
		No ▶	REPLACE CANP solenoid. RERUN Quick Test.
KD7	CHECK VOLTAGE OF VPWR CIRCUIT		
• Key On, engine Off. • DVOM on 20V scale. • Measure voltage between VPWR at the CANP solenoid vehicle harness connector and battery ground. • Is voltage reading 10.5 volts or greater?		Yes ▶	GO to **KD8**.
		No ▶	SERVICE harness open circuit. RERUN Quick Test.

Canister Purge (CANP) Pinpoint Test KD

TEST STEP	RESULT ▶	ACTION TO TAKE
KD8 CHECK CONTINUITY OF CANP CIRCUIT		
• Key Off, wait 10 seconds. • Disconnect processor and inspect both 60 Pin connectors and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Connect Breakout box to harness. Leave processor disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 31 (test Pin 35 for 1.9L CFI engines, test Pin 32 for 1.9L EFI engines) at the Breakout box and CANP on the vehicle harness connector. • Is resistance reading less than 5 ohms?	Yes ▶	GO to **KD9**.
	No ▶	SERVICE open circuit. RERUN Quick Test.
KD9 CHECK FOR SHORT TO GROUND		
• Key Off, wait 10 seconds. • Leave Breakout box to harness. Leave processor disconnected. • Disconnect CANP solenoid. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 31 (test Pin 35 for 1.9L CFI engines, test Pin 32 for 1.9L EFI engines) and test Pins 40, 46 and 60 at the Breakout box. • Are all resistance readings 10,000 ohms or greater?	Yes ▶	GO to **KD10**.
	No ▶	SERVICE short to ground. RERUN Quick Test.
KD10 CHECK FOR SHORT TO POWER		
• Key Off, wait 10 seconds. • DVOM on 200,000 ohm scale. • Leave Breakout box installed and processor disconnected. • CANP solenoid disconnected. • Measure resistance between test Pin 31 (test Pin 35 for 1.9L CFI engines, test Pin 32 for 1.9L EFI engines) and test Pins 37 and 57 at the Breakout box. • Are both resistance readings 10,000 ohms or greater?	Yes ▶	REMOVE Breakout box. REPLACE processor. RERUN Quick Test.
	No ▶	SERVICE short to power. REPEAT Quick Test. If code is repeated, REPLACE processor. RERUN Quick Test.

Idle Speed Control (Bypass Air) | Pinpoint Test | KE

KE



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9672-A

STOP-WARNING

You should enter this Pinpoint Test only when a service code 12, 13, 16 and 17 is received in Quick Test Step 5.0 or when directed here from Diagnostic by Symptom in the Engine Supplement Section.

CAUTION: If the engine exhibits rough running and/or idle, correct these conditions before diagnosing Idle Speed Control (ISC). Rough running/misses may be caused by:

- **Ignition System**
  Refer to Section 15
- **Fuel System**
  Refer to Pinpoint Test Steps HA1 through HA7.
  Refer to Pinpoint Test Steps HE1 through HE7.
  Refer to Pinpoint Test Steps HG1 through HG6.
  Refer to Pinpoint Test Steps HC2 through HC9.
- **EGR System, Section 6**

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Engine not up to operating temperature
- Engine over operating temperature
- Improper Idle Speed Throttle Stop Adjustment
- A/C input (electrical problem)
- Throttle Speed Control Linkage
- Throttle Sticking or Linkage Binding.

This Pinpoint Test is intended to diagnose only the following:

- RPM in Self-Test only
- ISC Actuator
- Harness Circuits ISC and VPWR
- Processor Assembly

Idle Speed Control (Bypass Air)

Pinpoint Test

KE

TEST STEP	RESULT ▶	ACTION TO TAKE
KE1 RPM DROP		
• Key Off. • Connect engine tachometer. • Start engine. • Disconnect ISC harness connector. • Does rpm drop or stall?	Yes ▶	GO to **KE2**.
	No ▶	GO to **KE3**.
KE2 CHECK FOR EGR CODES		
• Are service codes 31, 32, 33 or 34 present?	Yes ▶	GO to Quick Test Step 5.0 for appropriate Pinpoint Test.
	No ▶	GO to **KE3**.
KE3 CHECK FOR OTHER EEC CODES		
• Are service codes 22, 41, 42, 91 or 92 present?	Yes ▶	GO to Quick Test Step 5.0 for appropriate Pinpoint Test.
	No ▶	GO to **KE4**.
KE4 MEASURE ISC SOLENOID RESISTANCE		
• Key Off. • DVOM on 200 ohm scale. • Disconnect ISC solenoid connector and measure solenoid resistance. • Is resistance between 7 and 13 ohms?	Yes ▶	GO to **KE5**.
	No ▶	REPLACE ISC solenoid. RERUN Quick Test.
KE5 ISC SHORT TO CASE (GROUND) CHECK		
• Key Off. • DVOM on 200,00 ohm scale. • ISC solenoid disconnected. • Measure resistance from either ISC pin to ISC housing. • Is resistance greater than 10,000 ohms?	Yes ▶	GO to **KE6**.
	No ▶	REPLACE ISC solenoid. RERUN Quick Test.

Idle Speed Control (Bypass Air)

Pinpoint Test

KE

TEST STEP	RESULT ▶	ACTION TO TAKE
KE6 CHECK VOLTAGE OF VPWR CIRCUIT		
◦ Key On, Engine Off. ◦ DVOM on 20V scale. ◦ ISC solenoid disconnected. ◦ Measure voltage between VPWR at the ISC solenoid harness connector and battery ground. ◦ Is voltage less than 10.5 volts?	Yes ▶ No ▶	SERVICE harness open circuit. RERUN Quick Test. GO to KE7.
KE7 CHECK CONTINUITY OF ISC CIRCUIT		
◦ Key Off, wait 10 seconds. ◦ ISC solenoid disconnected. ◦ Disconnect processor and inspect both 60 Pin connectors for damaged pins, corrosion, loose wires. Service as necessary. ◦ Connect Breakout box to harness. Leave processor disconnected. ◦ DVOM on 200 ohm scale. ◦ Measure resistance between test Pin 21 at the Breakout box and ISC circuit at vehicle harness connector. ◦ Is resistance greater than 5 ohms?	Yes ▶ No ▶	SERVICE open circuit. RERUN Quick Test. GO to KE8.
KE8 CHECK FOR SHORT TO GROUND		
◦ Key Off, wait 10 seconds. ◦ Leave Breakout box installed and processor disconnected. ◦ ISC solenoid disconnected. ◦ DVOM on 200,000 ohm scale. ◦ Measure resistance between test Pin 21 and test Pins 40, 46 and 60 at the Breakout box. ◦ Is any resistance less than 10,000 ohms?	Yes ▶ No ▶	SERVICE short to ground. RERUN Quick Test. GO to KE9.

Idle Speed Control (Bypass Air)

Pinpoint Test

KE

TEST STEP	RESULT ▶	ACTION TO TAKE
KE9 CHECK FOR SHORT TO POWER		
• Key Off, wait 10 seconds. • DVOM on 200,000 ohm scale. • ISC solenoid disconnected. • Leave Breakout box connected to harness. Leave processor disconnected. • Place positive test lead to test Pin 37 and negative test lead to test Pin 21 to measure resistance. • Is resistance greater than 10,000 ohms?	Yes ▶ No ▶	GO to KE10. SERVICE short to power. RERUN Quick Test. If code or symptom is present, REPLACE processor.
KE10 CHECK FOR ISC SIGNAL FROM THE PROCESSOR		
• Key Off. • Connect processor and ISC actuator. • DVOM on a 20V scale. • Breakout box installed. • Connect DVOM between test Pin 21 and test Pin 40. • Start engine. • Slowly increase and decrease rpm. Does DVOM voltage vary?	Yes ▶ No ▶	GO to KE11. REPLACE processor. RERUN Quick Test.
KE11 VERIFY CURB IDLE		
• Go to Section 4 to verify curb idle. • Is curb idle within specification?	Yes ▶ No ▶	REPLACE ISC actuator. RERUN Quick Test. CHECK engine vacuum hoses. REFER to VECI decal. CHECK that throttle plates are fully closed, CHECK throttle linkage and/or speed control linkage for binding. If OK, REPLACE ISC actuator. RERUN Quick Test.

Idle Speed Control (Bypass Air)

Pinpoint Test

KE

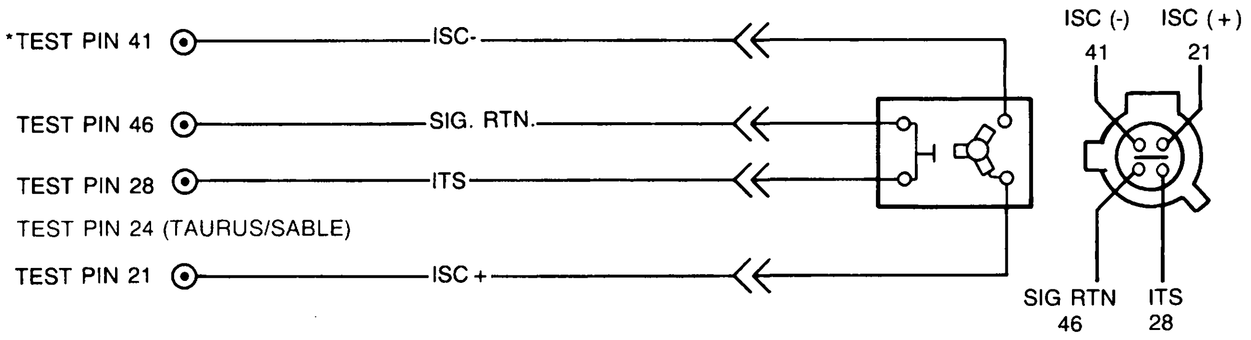
TEST STEP	RESULT ▶	ACTION TO TAKE
KE12 CURB IDLE CHECK		
• Key Off, wait 10 seconds. • Deactivate Self-Test. • Run engine at 2000 rpm for 2 minutes or until inlet radiator hose is hot and pressurized. • Key Off, wait 10 seconds. • Run Engine Running Self-Test. • Is code 17 still present?	Yes ▶	INSPECT throttle body and air inlet for contamination. SERVICE as necessary. If OK, ADJUST curb idle (REFER to Section 4 for procedure). RERUN Quick Test.
	No ▶	SERVICE other codes as necessary.
KE15 CODE 13 HIGH RPM CHECK		
• Key Off. • Connect tachometer. • Start engine. • Disconnect ISC harness connector. • Does rpm drop or engine stall?	Yes ▶	REPLACE processor. RERUN Quick Test.
	No ▶	CHECK engine vacuum hoses. REFER to VECI decal. VERIFY curb idle. CHECK that throttle plates are fully closed, CHECK throttle linkage and/or speed control linkage for binding. If OK, REPLACE ISC actuator. RERUN Quick Test.
KE20 SERVICE CODE: 48		
• SERVICE holes, cracks, and/or disconnections to air cleaner outlet tube (between vane airflow meter and fuel charging assembly). • Perform Engine Running Self-Test. • Is code 48 present?	Yes ▶	CHECK for other source of excessive unmetered airflow.
	No ▶	EEC system OK for metered air. GO to Quick Test Step **5.0B** to service other code if necessary.

Idle Speed Control (DC Motor/Idle Tracking Switch Assembly) — 2.5L CFI, 3.8L CFI

Pinpoint Test

KF

KF



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9673-B

STOP-WARNING

You should enter this Pinpoint Test only when a Service Code 12, 13, 58 or 68 is received in Quick Test Step 3.0, 5.0 or 6.0 or when directed here from Diagnostics by Symptom in the Engine Supplement Section.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Anti-Diesel Speed too High
- Basic Engine
- Vacuum Leaks
- Throttle Sticking or on High Cam

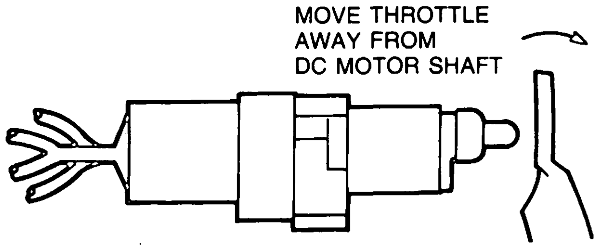
This Pinpoint Test is intended to diagnose only the following:

- DC Motor
- Idle Tracking Switch
- Harness circuits: ISC+, ISC−, Signal Return and ITS
- Processor Assembly

Idle Speed Control (DC Motor/Idle Tracking Switch Assembly) — 2.5L CFI, 3.8L CFI

Pinpoint Test

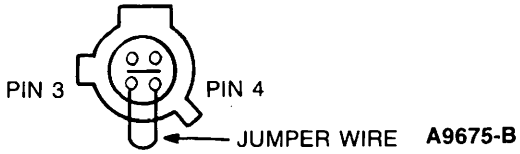
KF

TEST STEP	RESULT ▷	ACTION TO TAKE
KF1 SERVICE CODE 68: SIMULATE NO THROTTLE CONTACT TO FORCE A CODE 11 IN KEY ON — ENGINE OFF TEST		
o Key Off, wait 10 seconds. o Move throttle away from ISC DC motor shaft. o Perform Key On Engine Off Self-Test. o Is code 68 present? **NOTE: Ignore all other codes at this point.**  A9674-A	Yes ▷	RELEASE throttle and GO to KF3.
	No ▷	RELEASE throttle and GO to Pinpoint Test Step KF2.
KF2 RETRACT ISC DC MOTOR		
o Key Off, wait 10 seconds. o Connect Breakout box to harness. Leave processor disconnected. o Jumper test Pin 41 to test Pin 1 at the Breakout box and test Pin 21 at the Breakout box to battery ground (to retract DC motor). o Observe DC motor. NOTE: **Do not leave jumper wire in test pins if the motor will not move; it will damage Breakout box wiring.**	Motor does not retract ▷	REMOVE jumper and GO to KF5.
	Motor retracts and still contacts throttle lever ▷	GO to ISC Adjustments, Section 4.
	Motor retracts and does not contact throttle lever ▷	REMOVE jumper and GO to KF25.

Idle Speed Control (DC Motor/Idle Tracking Switch Assembly) — 2.5L CFI, 3.8L CFI

Pinpoint Test

KF

TEST STEP	RESULT ▶	ACTION TO TAKE
KF3 SIMULATE A CLOSED CONTACT CONDITION IN KEY ON — ENGINE OFF TEST		
• Key Off, wait 10 seconds. • Disconnect harness from ISC. • Connect jumper between ISC vehicle harness connector Pins 3 and 4. • Install jumper as shown. • Perform Key On Engine Off Self-Test. • Is code 68 present? ISC HARNESS CONNECTOR  **CAUTION: Do not short any other pins.**	Yes ▶	GO to KF4.
	No ▶	REPLACE ISC DC motor. RERUN Quick Test.
KF4 CHECK ITS AND SIGNAL RETURN CIRCUITS FOR CONTINUITY		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Leave Breakout box installed. Leave processor disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 46 at the Breakout box and Signal Return circuit at ISC vehicle harness connector and between test Pin 28* at the Breakout box and ITS circuit at ISC vehicle harness connector. *Test Pin 24 on Taurus/Sable vehicles.	Either resistance 5 ohms or greater ▶	SERVICE faulty circuit. RERUN Quick Test.
	Both resistances less than 5 ohms ▶	REPLACE processor. RERUN Quick Test.

Idle Speed Control (DC Motor/Idle Tracking Switch Assembly) — 2.5L CFI, 3.8L CFI

Pinpoint Test

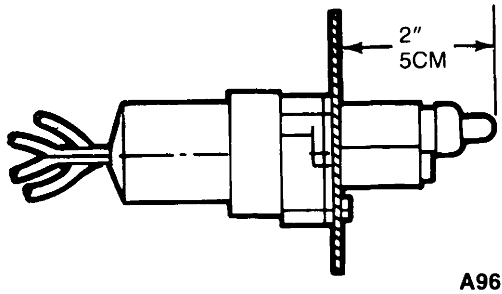
KF

TEST STEP	RESULT ▶	ACTION TO TAKE
KF5 CHECK ISC CIRCUITS FOR CONTINUITY		
- Key Off, wait 10 seconds. - Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. - Connect Breakout box. Leave processor disconnected. - Disconnect harness connector for ISC motor. - DVOM on 200 ohm scale. - Measure resistance between test Pin 41 at the Breakout box and ISC − circuit at vehicle harness connector and between test Pin 21 at the Breakout box and ISC + circuit at vehicle harness connector.	Both resistance readings are less than 5 ohms ▶	GO to **KF6**.
	Either resistance reading is 5 ohms or greater ▶	SERVICE faulty circuits. RERUN Quick Test.
KF6 CHECK ISC + AND ISC − CIRCUITS FOR SHORTS TO POWER		
- Key On Engine Off. - Leave Breakout box installed. Leave processor disconnected. - Harness disconnected from ISC motor. - DVOM on 20V scale. - Measure voltage between test Pin 41 and test Pins 40 and 60 at the Breakout box. Measure voltage between test Pin 21 and test Pins 40 and 60 at the Breakout box.	All voltage readings are less than 1V ▶	GO to **KF7**.
	Any voltage reading is 1V or more ▶	SERVICE circuit short to power. RERUN Quick Test. If code 12 is still present, REPLACE processor.
KF7 CHECK ISC + AND ISC − CIRCUITS FOR SHORTS TO GROUND		
- Key Off, wait 10 seconds. - Leave Breakout box installed. Leave processor disconnected. - Harness disconnected from ISC motor. - DVOM on 200,000 ohm scale. - Measure resistance between test Pin 41 and test Pins 40, 46 and 60 at the Breakout box. Measure resistance between test Pin 21 and test Pins 40, 46 and 60 at the Breakout box.	All resistance readings greater than 10,000 ohms ▶	GO to **KF8**.
	Any resistance reading is 10,000 ohms or less ▶	SERVICE faulty circuit. RERUN Quick Test. If code 12 is still present, REPLACE processor.

Idle Speed Control (DC Motor/Idle Tracking Switch Assembly) — 2.5L CFI, 3.8L CFI

Pinpoint Test

KF

TEST STEP		RESULT ▶	ACTION TO TAKE
KF8	PREPARE IDLE SPEED CONTROL DC MOTOR FOR OPERATION		
	• Key Off, wait 10 seconds. • Leave Breakout box installed. Leave processor disconnected. • Harness disconnected from ISC motor. • DVOM on 20V scale. • Connect DVOM positive test lead to test Pin 1 at the Breakout box and negative test lead to ground.	Voltage reading is 10.5V or greater ▶	GO to **KF9**.
		Voltage reading is less than 10.5V ▶	SERVICE open in KAPWR circuit. RERUN Quick Test. If code 12 is still present, GO to **KF9**.
KF9	ISC DC MOTOR OPERATION CHECK		
	• Key Off, wait 10 seconds. • Leave Breakout box installed. Leave processor disconnected. • Connect ISC DC motor to harness connector. • Jumper test Pin 21 to test Pin 1 at the Breakout box and test Pin 41 at the Breakout box to ground (to extend DC motor). • Does DC motor shaft extend 5 cm (2 inches) or more?  A9676-A	Yes ▶	GO to **KF10**.
		No ▶	REPLACE DC motor. RERUN Quick Test.
KF10	RETRACT ISC DC MOTOR		
	• Key Off, wait 10 seconds. • Leave Breakout box installed. Leave processor disconnected. • Jumper test Pin 41 to test Pin 1 at the Breakout box and test Pin 21 at the Breakout box to ground (to retract DC motor). • Does ISC DC motor retract?	Yes ▶	GO to **KF11**.
		No ▶	REPLACE DC motor. RERUN Quick Test.

Idle Speed Control (DC Motor/Idle Tracking Switch Assembly) — 2.5L CFI, 3.8L CFI

Pinpoint Test

KF

TEST STEP	RESULT ▶	ACTION TO TAKE
KF11 EXTEND ISC DC MOTOR		
• Key Off, wait 10 seconds. • Leave Breakout box installed. Leave processor disconnected. • Jumper test Pin 21 to test Pin 1 at the Breakout box and test Pin 41 at the Breakout box to ground (to extend DC motor). • Does ISC DC motor extend?	No ▶	REPLACE DC motor. RERUN Quick Test.
	Yes ▶	REPLACE processor. RERUN Quick Test.
KF12 SERVICE CODE 58: SIMULATE THROTTLE CONTACT TO FORCE A SERVICE CODE 68 IN KEY ON — ENGINE OFF TEST		
• Key Off, wait 10 seconds. • Press on ISC DC motor shaft to simulate throttle contact. • With a force pushing on DC motor shaft, perform Key On Engine Off Self-Test. **NOTE: Ignore all other codes at this point.** • Is code 68 present?	Yes ▶	GO to Pinpoint Test Step **KF5**.
	No ▶	GO to **KF13**.
KF13 RETRACT ISC DC MOTOR		
• Key Off, wait 10 seconds. • Leave Breakout box installed. Leave processor disconnected. • Jumper test Pin 41 to test Pin 1 at the Breakout box and test Pin 21 at the Breakout box to ground (to retract DC motor). • Does ISC DC motor retract?	Yes ▶	GO to ISC Adjustments, Section 4.
	No ▶	GO to **KF14**.
KF14 IDLE TRACKING SWITCH ALWAYS "NOT TRACKING" (CLOSED)		
• Key Off, wait 10 seconds. • Reconnect processor. • Disconnect vehicle harness from ISC. • Perform Key On Engine Off Self-Test. **NOTE: Ignore all other codes at this point.** • Is code 68 present?	Yes ▶	REPLACE DC motor. RERUN Quick Test.
	No ▶	GO to **KF15**.

Idle Speed Control (DC Motor/Idle Tracking Switch Assembly) — 2.5L CFI, 3.8L CFI

Pinpoint Test

KF

TEST STEP	RESULT ►	ACTION TO TAKE
KF15 CHECK ITS CIRCUIT FOR SHORT TO GROUND		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Connect Breakout box. Disconnect processor. • Harness disconnected at ISC. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 28* and test Pins 40, 46 and 60 at the Breakout box. *Test Pin 24 Taurus/Sable.	Any resistance less than 10,000 ohms ►	SERVICE short to ground. RERUN Quick Test.
	All resistances 10,000 ohms or more ►	REPLACE processor. RERUN Quick Test.
KF16 DC MOTOR CONTROL FAULT ISOLATION: SERVICE CODE 12		
• Are service codes 58, 68, 31 or 41 present?	Yes ►	GO to Quick Test Step 5.0 B for next appropriate Pinpoint Code.
	No ►	GO to **KF17**.
KF17 CHECK FOR THROTTLE STICKING		
• Check throttle plates and linkages for binding. • Check speed control for binding (if so equipped).	Yes ►	SERVICE as necessary. RERUN Quick Test.
	No ►	GO to **KF18**.
KF18 EXTEND ISC DC MOTOR		
• Key Off, wait 10 seconds. • Leave Breakout box installed. Leave processor disconnected. • Jumper test Pin 21 to test Pin 1 at the Breakout box and test Pin 41 at the Breakout box to ground (to extend DC motor). • Does ISC DC motor extend?	No ►	REPLACE DC motor. RERUN Quick Test.
	Yes ►	REPLACE processor. RERUN Quick Test.

Idle Speed Control (DC Motor/Idle Tracking Switch Assembly) — 2.5L CFI, 3.8L CFI

Pinpoint Test

KF

TEST STEP	RESULT ▶	ACTION TO TAKE
KF19 ENGINE RUNNING CODES 13 AND/OR 16		
o Prepare system for normal engine operation. o Deactivate Self-Test. o Air conditioner Off. o Run engine. Alternate between 30 seconds at idle and 5 seconds at part throttle modes for 3 minutes. o Is idle speed erratic?	No ▶	GO to **KF20**.
	Yes ▶	CHECK for: o Vacuum leaks o Code 22 o Code 31 o Code 41 o Code 58 SERVICE above codes as necessary before continuing.
KF20 CHECK FOR THROTTLE STICKING OR CHOKE POSITION		
o Inspect throttle mechanisms (plate linkage) for sticking or binding. o Are above inspections satisfactory?	No ▶	SERVICE fault. RERUN Quick Test.
	Yes ▶	GO to **KF21**.
KF21 PERFORM KEY ON — ENGINE OFF TEST. OBSERVE ON DEMAND CODES		
o Perform Key On Engine Off Test. Record On Demand codes. o Key On Engine Off. o Is code 68 present?	Yes ▶	GO to Pinpoint Test Step **KF1**.
	No ▶	REFER to Section 4 for anti-diesel speed adjustment.
KF25 CHECK ISC+ AND ISC− CIRCUITS FOR SHORTS TO GROUND		
o Key Off, wait 10 seconds. o Leave Breakout box installed. Leave processor disconnected. o Harness disconnected from ISC motor. o DVOM on 200,000 ohm scale. o Measure resistance between test Pin 41 and test Pins 40, 46 and 60 at the Breakout box. Measure resistance between test Pin 21 and test Pins 40, 46 and 60 at the Breakout box.	All resistance readings greater than 10,000 ohms ▶	GO to **KF26**.
	Any resistance reading is 10,000 ohms or less ▶	SERVICE faulty circuit. RERUN Quick Test. If code 12 is still present, REPLACE processor.

Idle Speed Control (DC Motor/Idle Tracking Switch Assembly) — 2.5L CFI, 3.8L CFI

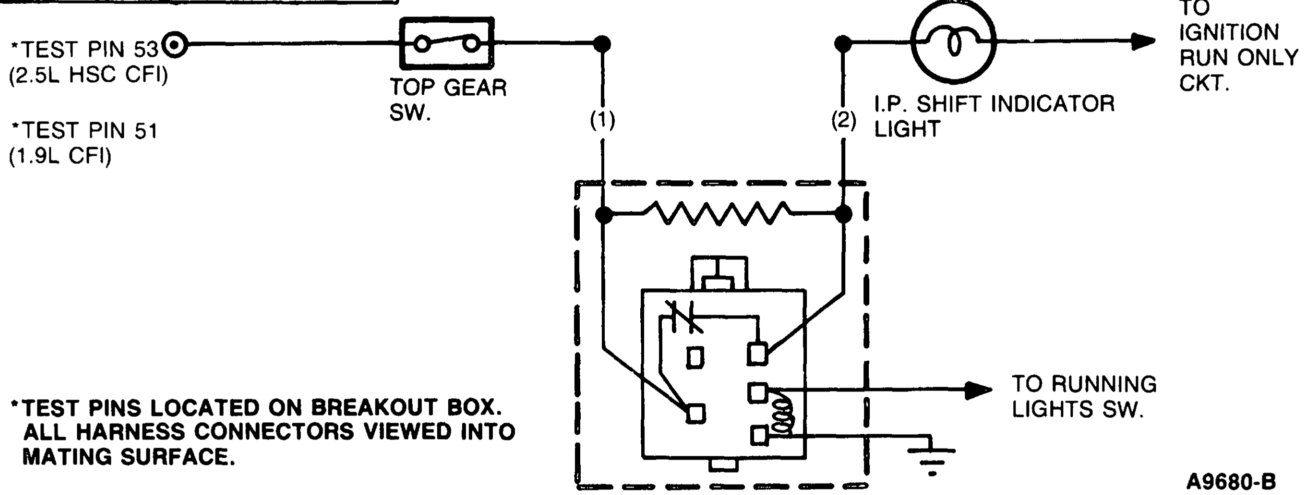
Pinpoint Test

KF

TEST STEP	RESULT ▶	ACTION TO TAKE
KF26 CHECK ISC+ AND ISC− CIRCUITS FOR SHORTS TO POWER		
• Key On Engine Off. • Leave Breakout box installed. Leave processor disconnected. • Harness disconnected from ISC motor. • DVOM on 20V scale. • Measure voltage between test Pin 41 and test Pins 40 and 60 at the Breakout box. Measure voltage between test Pin 21 and test Pins 40 and 60 at the Breakout box.	All voltage readings are less than 1V ▶	RECONNECT DC motor. GO to KF27.
	Any voltage reading is 1V or more ▶	SERVICE circuit short to power. RERUN Quick Test. If code 12 is still present, REPLACE processor.
KF27 EXTEND ISC DC MOTOR		
• Key Off, wait 10 seconds. • Leave Breakout box installed. Leave processor disconnected. • Jumper test Pin 21 to test Pin 1 at the Breakout box and test Pin 41 at the Breakout box to ground (to extend DC motor). • Does ISC DC motor extend?	No ▶	REPLACE DC motor. RERUN Quick Test.
	Yes ▶	REPLACE processor. RERUN Quick Test.

Shift Indicator Light (SIL) | Pinpoint Test | KL

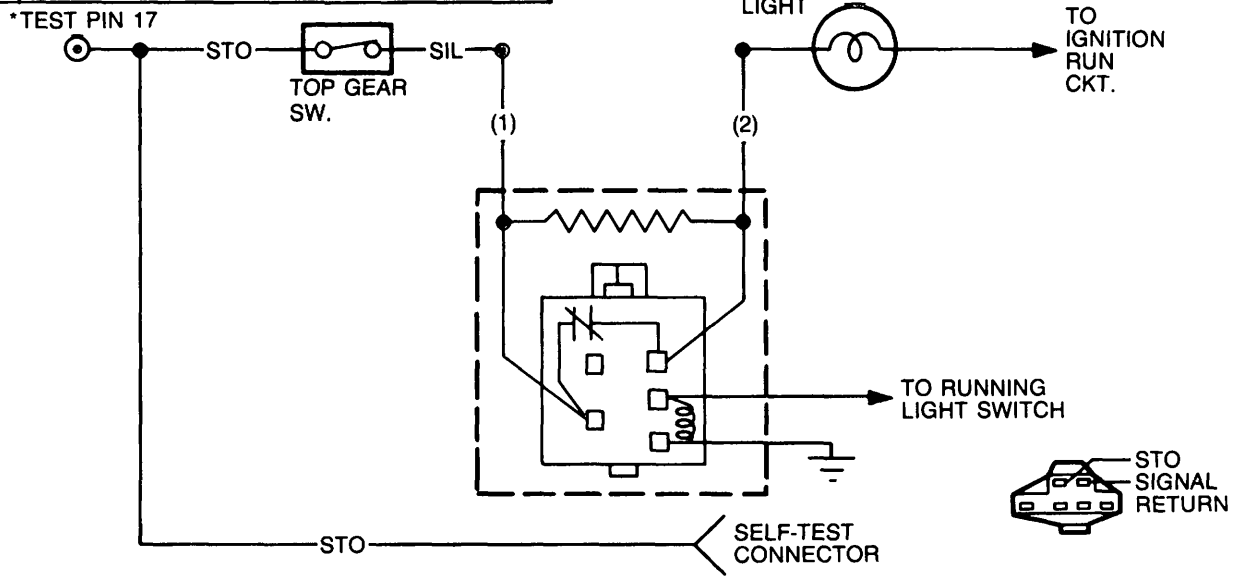
KL 1.9L CFI, 2.5 HSC CFI



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9680-B

KL ALL OTHERS



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9681-B

STOP-WARNING

You should enter this Pinpoint Test only when directed here from Diagnostics by Symptom in the Engine Supplement Section or from Pinpoint Test Step Q9A.

This Pinpoint Test is intended to diagnose only the following:

- Top Gear Switch
- Shift Indicator Light Bulb and Fuse
- Harness Circuits: SIL and STO

Shift Indicator Light (SIL)

Pinpoint Test

KL

TEST STEP	RESULT ▶	ACTION TO TAKE
KL1 ENTER OUTPUT STATE CHECK IN NEUTRAL (REFER TO APPENDIX)		
NOTE: Do not use STAR tester for this Step, use VOM/DVOM. • Key Off, wait 10 seconds. • Transmission in neutral. • DVOM on 20V scale. • Connect DVOM negative test lead to STO at the Self-Test connector and positive test lead to battery positive. • Jumper STI to signal return at the Self-Test connector. • Perform Key On, Engine Off Self-Test until the completion of the Continuous Test Codes. • DVOM will indicate zero volts when test is complete. • Depress and release the throttle. • Did DVOM reading change to a high voltage reading?	Yes ▶	REMAIN in output state check, Go to KL2.
	No ▶	DEPRESS throttle to WOT and release. If STO voltage does not go high, GO to Pinpoint Test Step KL7. Leave equipment hooked up.
KL2 CHECK FOR ELECTRICAL CYCLING AT DIMMER RELAY INPUT		
• DVOM on 20V scale. • Reconnect DVOM positive test lead to battery positive terminal and negative test lead to Pin 1 on dimmer relay. • While observing DVOM, depress and release the throttle several times to cycle Pin 1 On and Off. • Does Pin 1 cycle On and Off?	Yes ▶	GO to KL3.
	No ▶	GO to KL5.
KL3 CHECK FOR ELECTRICAL CYCLING AT DIMMER RELAY OUTPUT		
• DVOM on 20V scale. • Reconnect DVOM positive test lead to battery positive terminal and negative test lead to Pin 2 on dimmer relay. • While observing DVOM, depress and release the throttle several times to cycle Pin 2 On and Off. • Does Pin 2 cycle On and Off?	Yes ▶	REMOVE jumper, GO to KL4.
	No ▶	REMOVE jumper. REPLACE dimmer relay.

Shift Indicator Light (SIL)

Pinpoint Test

KL

TEST STEP		RESULT ▶	ACTION TO TAKE
KL4	CHECK CONTINUITY BETWEEN DIMMER RELAY OUTPUT AND SIL BULB		
	o Key Off, wait 10 seconds. o DVOM on 200 ohm scale. o Measure resistance between Pin 2 of dimmer relay connector and SIL bulb. o Is resistance reading 5 ohms or greater?	Yes ▶ No ▶	SERVICE harness open circuit. RERUN Quick Test. REPLACE SIL bulb.
KL5	CHECK FOR ELECTRICAL CYCLING AT SIL SIDE OF TOP GEAR SWITCH		
	o DVOM on 20V scale. o Reconnect DVOM positive lead to battery positive terminal and negative test lead to SIL circuit of top gear switch. o While observing DVOM, depress and release the throttle several times to cycle SIL circuit On and Off. o Does SIL circuit cycle On and Off?	Yes ▶ No ▶	SERVICE harness open circuit. RERUN Quick Test. 4.9L only, change SIL bulb. GO to **KL6**.
KL6	CHECK FOR ELECTRICAL CYCLING AT STO SIDE OF TOP GEAR SWITCH		
	o DVOM on 20V scale. o Reconnect DVOM positive lead to battery positive terminal and negative test lead to STO circuit of top gear switch. o While observing DVOM, depress and release the throttle several times to cycle STO circuit On and Off. o Does STO circuit cycle On and Off?	Yes ▶ No ▶	CHANGE top gear switch. SERVICE harness open circuit. RERUN Quick Test.

Shift Indicator Light (SIL)

Pinpoint Test

KL

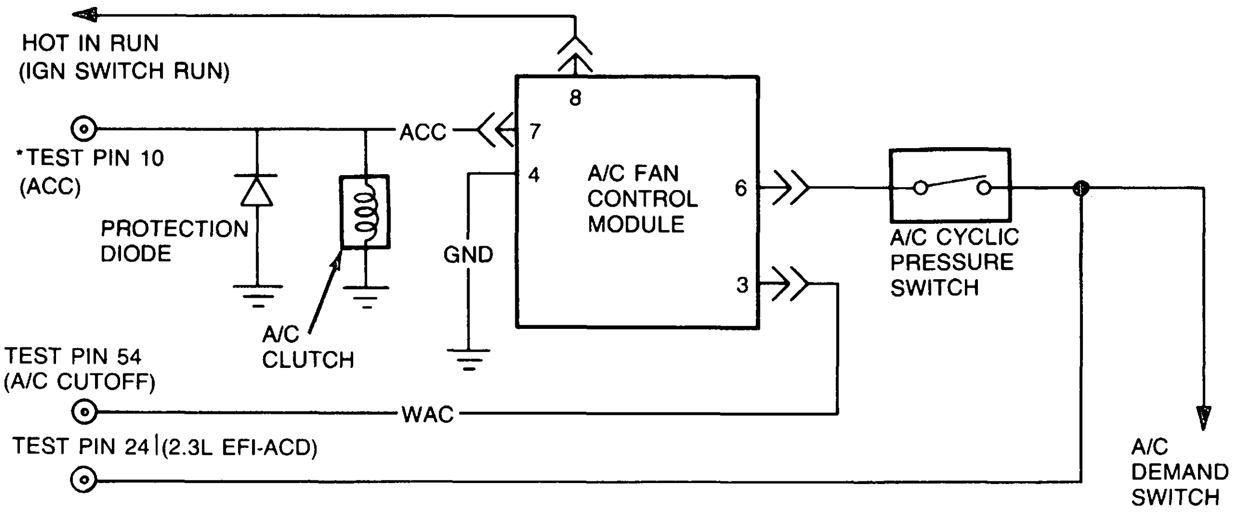
TEST STEP	RESULT ▶	ACTION TO TAKE
KL7 ENTER OUTPUT STATE CHECK IN TOP GEAR (REFER TO APPENDIX)		
NOTE: Do not use STAR tester for this Step, use VOM/DVOM. • Key Off, wait 10 seconds. • Transmission in top gear. • DVOM on 20V scale. • Reconnect DVOM negative test lead to STO at the Self-Test connector and positive test lead to battery positive. • Jumper STI to signal return at the Self-Test connector. • Perform Key On, Engine Off Self-Test until the completion of the Continuous Test Codes. • DVOM will indicate zero volts when test is complete. • Depress and release the throttle. • Did DVOM reading change to a high voltage reading?	Yes ▶ No ▶	CHECK SIL bulb and fuse 15. If OK, SERVICE short to ground in SIL circuit. GO to Pinpoint Test Step Q40.

WOT A/C Cutoff (WAC) A/C Demand

Pinpoint Test

KM

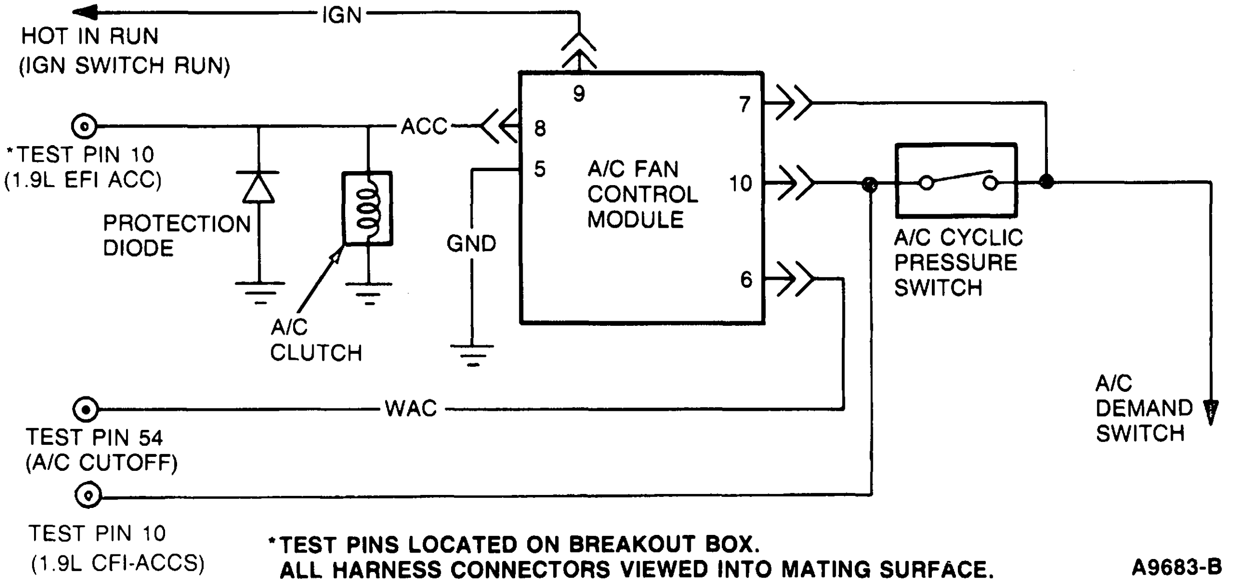
KM 2.3L EFI TC, 2.3L EFI CAR, 2.3L CFI ENGINES



*TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9682-B

KM 1.9L EFI, 1.9L CFI ENGINES



*TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

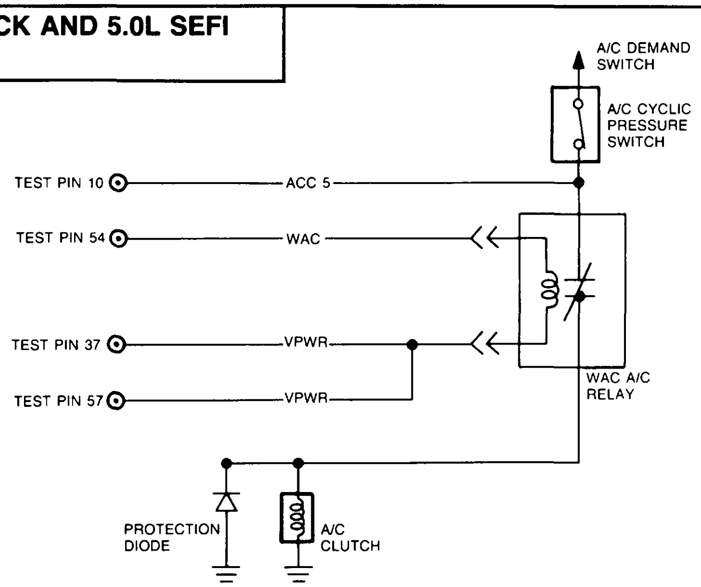
A9683-B

WOT A/C Cutoff (WAC) A/C Demand

Pinpoint Test

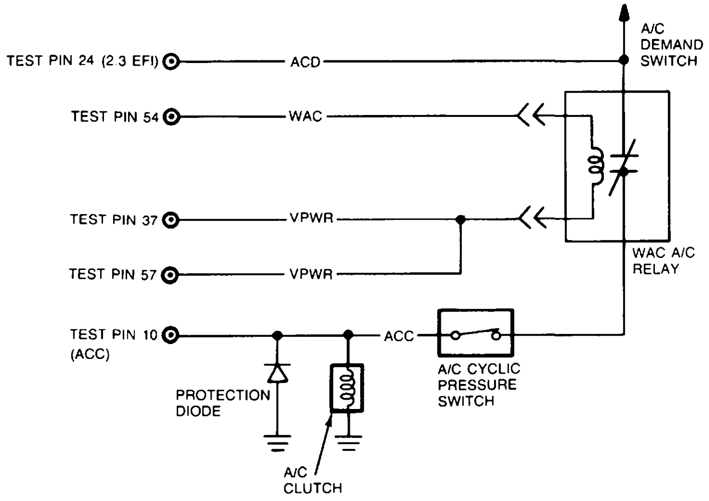
KM

KM 2.9L EFI, 3.0L EFI TRUCK AND 5.0L SEFI ENGINES



A9684-B

KM 2.3L EFI TRUCK AND 3.8L CFI ENGINES



A9685-B

STOP-WARNING

You should enter this Pinpoint Test only when directed here from Diagnostics by Symptom in the Engine Supplement Section.

This Pinpoint Test is intended to diagnose only the following:

- Harness Circuits: WAC and V PWR
- WOT A/C Cut-Off Relay
- Processor Assembly
- A/C Demand Switch

WOT A/C Cutoff (WAC) A/C Demand

Pinpoint Test

KM

TEST STEP	RESULT ►	ACTION TO TAKE
KM1 ENTER OUTPUT STATE CHECK (REFER TO APPENDIX)		
NOTE: Do not use STAR tester for this Step, use VOM/DVOM. ⊙ Key Off, wait 10 seconds. ⊙ DVOM on 20V scale. ⊙ Connect DVOM negative test lead to STO at the Self-Test connector and positive test lead to battery positive. ⊙ Jumper STI to signal return at the Self-Test connector. ⊙ Perform Key On, Engine Off Self-Test until the completion of the Continuous Test Codes. ⊙ DVOM will indicate zero volts when test complete. ⊙ Depress and release the throttle. ⊙ Did DVOM reading change to a high voltage reading?	Yes ►	REMAIN in Output State Check. GO to KM2.
	No ►	DEPRESS throttle to WOT and RELEASE. If STO voltage does not go high, GO to Pinpoint Test Step Q40. Leave equipment hooked up.
KM2 CHECK A/C CLUTCH ELECTRICAL OPERATION		
⊙ Key On, engine Off. ⊙ Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. ⊙ Connect Breakout box to harness. Reconnect processor. ⊙ A/C switch to A/C. ⊙ DVOM on 20V scale. ⊙ Reconnect DVOM positive test lead to test Pin 37 and negative test lead to test Pin 54 at the Breakout box. ⊙ While observing DVOM, depress and release the throttle several times (to cycle output On and Off). ⊙ Does A/C clutch output cycle On and Off?	Yes ►	EEC-IV system OK. Refer to Shop Manual, Group 36.
	No ►	REMOVE jumper. GO to KM3.
KM3 FAN CONTROL MODULE OR WAC RELAY		
⊙ A/C fan/control module applications 1.9L EFI, 1.9L CFI, 2.3L EFI, 2.3L CFI engines.	A/C fan control ►	GO to KM4.
⊙ All other systems with WAC relay.	WAC relay ►	GO to KM10.

WOT A/C Cutoff (WAC) A/C Demand

Pinpoint Test

KM

TEST STEP		RESULT ▶	ACTION TO TAKE
KM4	CHECK CONTINUITY OF GROUND CIRCUIT TO FAN CONTROL MODULE		
	• Key Off, wait 10 seconds. • DVOM on 200 ohm scale. • Measure resistance of ground circuit between fan control module connector and battery ground. • Is resistance reading 5 ohms or greater?	Yes ▶ No ▶	SERVICE harness circuit. RERUN Quick Test. GO to **KM5**.
KM5	CHECK FOR IGN. CIRCUIT VOLTAGE		
	• Key On, engine Off. • DVOM on 20V scale. • Measure voltage between ignition circuit and ground circuit on the fan control module connector. • Is voltage reading 10.5 volts or greater?	Yes ▶ No ▶	GO to **KM6**. SERVICE open in ign. circuit. RERUN Quick Test.
KM6	CHECK CONTINUITY OF WAC CIRCUIT		
	• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Connect Breakout box to harness. Leave processor disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 54 at the Breakout box and WAC circuit at fan control module connector. • Is resistance reading 5 ohms or greater?	Yes ▶ No ▶	SERVICE harness WAC circuit. RERUN Quick Test. GO to **KM7**.
KM7	CHECK FOR SHORT TO GROUND ON WAC CIRCUIT		
	• Key Off, wait 10 seconds. • Leave Breakout box installed and processor disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 54 and test Pins 40, 46 and 60 at the Breakout box. • Are resistance readings 10,000 ohms or greater?	Yes ▶ No ▶	REPLACE processor. RERUN Quick Test. GO to **KM8**.

WOT A/C Cutoff (WAC) A/C Demand

Pinpoint Test

KM

TEST STEP	RESULT ▶	ACTION TO TAKE
KM8 CHECK FOR SHORT TO GROUND WITH FAN CONTROL MODULE DISCONNECTED		
o Key Off, wait 10 seconds. o Leave Breakout box installed and processor disconnected. o DVOM on 200,000 ohm scale. o Disconnect fan control module. o Measure resistance between test Pin 54 and test Pins 40, 46 and 60 at the Breakout box. o Are resistance readings 10,000 ohms or greater?	Yes ▶	REPLACE fan control module. RERUN Quick Test.
	No ▶	SERVICE harness short. RERUN Quick Test.
KM10 MEASURE WAC RELAY RESISTANCE		
o Key Off, wait 10 seconds. o DVOM on 200 ohm scale. o Disconnect WAC relay connector and measure relay resistance. o Is resistance reading less than 50 ohms or greater than 70 ohms?	Yes ▶	REPLACE WAC relay. RERUN Quick Test.
	No ▶	CONNECT WAC solenoid. GO to **KM11**.
KM11 CHECK VOLTAGE OF V PWR CIRCUIT		
o Key On, Engine Off. o DVOM on 20V scale. o Connect DVOM positive test lead to V PWR circuit and negative test lead to ground. o Measure voltage on WAC relay V PWR circuit. o Is voltage reading 10.5 volts or greater?	Yes ▶	GO to **KM12**.
	No ▶	SERVICE harness open circuit. RERUN Quick Test.
KM12 CHECK CONTINUITY OF WAC CIRCUIT		
o Key Off, wait 10 seconds. o Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. o Connect Breakout box to harness. Leave processor disconnected. o DVOM on 200 ohm scale. o Measure resistance between test Pin 54 at the Breakout box and WAC circuit at harness connector. o Is resistance reading 5 ohms or greater?	Yes ▶	SERVICE harness open circuit. RERUN Quick Test.
	No ▶	GO to **KM13**.

WOT A/C Cutoff (WAC) A/C Demand

Pinpoint Test

KM

TEST STEP	RESULT ▶	ACTION TO TAKE
KM13 CHECK FOR SHORT TO GROUND		
• Key Off, wait 10 seconds. • Leave Breakout box installed and processor disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 54 and test Pins 40, 46 and 60 at Breakout box. • Are all resistance readings greater than 10,000 ohms?	Yes ▶	GO to **KM14**.
	No ▶	SERVICE short to ground. RERUN Quick Test.
KM14 CHECK FOR SHORT TO POWER		
• Key Off, wait 10 seconds. • DVOM on 200,000 ohm scale. • Leave Breakout box installed and processor disconnected. • WAC solenoid disconnected. • Measure resistance between test Pin 54 and test Pins 37 and 57 at Breakout box. • Are all resistance readings greater than 10,000 ohms?	Yes ▶	GO to **KM15**.
	No ▶	SERVICE short to power. RERUN Quick Test. If symptom is still present REPLACE processor.
KM15 CYCLE A/C DEMAND SWITCH		
• Key Off, wait 10 seconds. • Processor disconnected. • DVOM on 20V scale. • Measure voltage between test Pin 10 and test Pin 40 at the Breakout box. • Does output cycle low to high (high being 10.5 volts or greater) when A/C switch is cycled?	Yes ▶	REPLACE processor. RERUN Quick Test.
	No ▶	REPAIR open in A/C input to test Pin 10. RERUN Quick Test.

WOT A/C Cutoff (WAC) A/C Demand

Pinpoint Test

KM

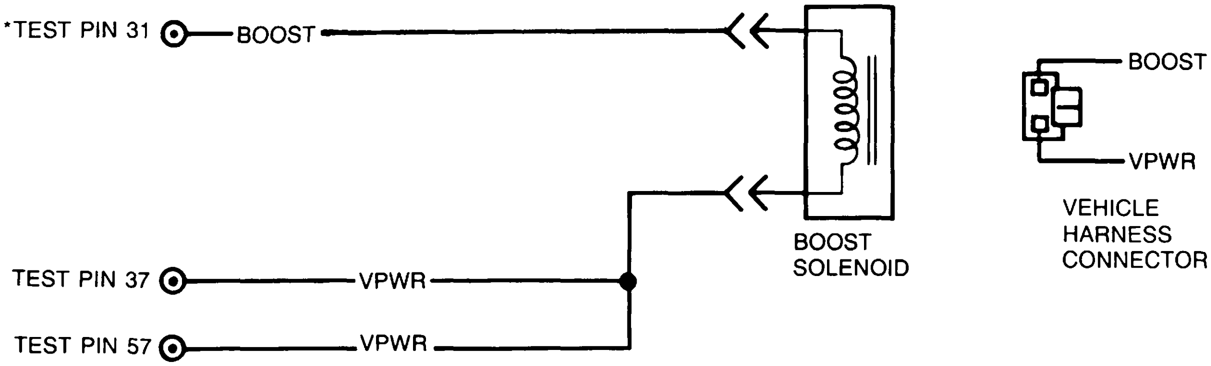
TEST STEP	RESULT ▶	ACTION TO TAKE
KM20 CYCLE A/C DEMAND SWITCH		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Connect Breakout box to harness. Leave processor disconnected. • DVOM on 20V scale. • Measure voltage between test Pin 10 (Pin 24 for 2.3L EFI) and test Pin 40 at the Breakout box. • Does output cycle 4.0-10.5V when A/C switch is cycled?	Yes ▶ No ▶	REPLACE processor. RERUN Quick Test. GO to KM21.
KM21 CHECK CONTINUITY OF ACC/ACD CIRCUIT		
• Key Off, wait 10 seconds. • DVOM on 200 ohm scale. • Measure resistance between ACC test Pin 10 at the Breakout box and A/C clutch. For 2.3L EFI, also measure resistance between ACD test Pin 24 at the Breakout box and A/C demand switch. • Is resistance reading 5 ohms or greater?	Yes ▶ No ▶	SERVICE harness circuit. RERUN Quick Test. EEC-IV system OK. REFER to Shop Manual, Group 36.

Turbo Boost

Pinpoint Test

KN

KN



*TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9686-B

STOP-WARNING

You should enter this Pinpoint Test only when a service code 81 is received in Quick Test Step 3.0 or when directed here from Diagnostics by Symptom in the Engine Supplement Section.

This Pinpoint Test is intended to diagnose only the following:

- Harness circuits: VPWR, Boost

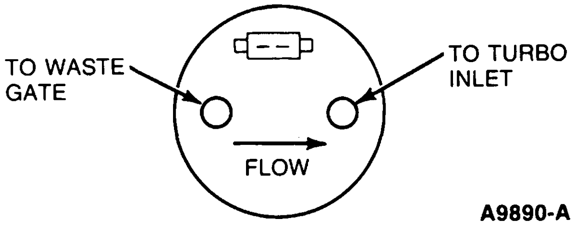
Turbo Boost

Pinpoint Test

KN

TEST STEP	RESULT ▶	ACTION TO TAKE
KN1 ENTER OUPUT STATE CHECK (REFER TO APPENDIX)		
NOTE: Do not use STAR tester for this Step, use VOM/DVOM. • Key Off, wait 10 seconds. • DVOM on 20V scale. • Connect DVOM negative test lead to STO at the Self-Test connector and positive test lead to battery positive. • Jumper STI to signal return at the Self-Test connector. • Perform Key On Engine Off Self-Test through the completion of the Continuous Test Codes. • DVOM will indicate zero volts when test is complete. • Depress and release the throttle. • Did DVOM reading change to a high votlage reading?	Yes ▶	REMAIN in Output State Check. GO to KN2.
	No ▶	DEPRESS throttle to WOT and release. If STO voltage does not go high, GO to Pinpoint Test Step Q40. Leave equipment hooked up.
KN2 CHECK BOOST OUTPUT ELECTRICAL OPERATION		
• Key On, Engine Off. • DVOM on 20V scale. • Connect DVOM positive test lead to circuit VPWR on boost solenoid connector and negative test lead to boost output on boost solenoid connector. • While observing DVOM, depress and release the throttle several times to cycle output On and Off. • Does boost output solenoid cycle On and Off?	Yes ▶	GO to KN3.
	No ▶	REMOVE jumper. GO to KN4.

Turbo Boost | Pinpoint Test | KN

TEST STEP	RESULT ▶	ACTION TO TAKE
KN3 CHECK BOOST SOLENOID FUNCTION		
• Remain in output state check. • Disconnect turbo boost control solenoid vacuum hose at the turbocharger inlet end. • Attach a vacuum pump to the hose. • Depress the throttle once to cycle the solenoid closed. • Apply vacuum to the solenoid. • Depress the throttle once again to cycle the solenoid open and release trapped vacuum. • Did the solenoid hold and then release vacuum? TURBO BOOST CONTROL SOLENOID  	Yes ▶	EEC-IV system OK. REFER to Shop Manual for boost diagnostics.
	No ▶	REPLACE solenoid. RERUN Quick Test.
KN4 MEASURE BOOST SOLENOID RESISTANCE		
• Key Off, wait 10 seconds. • DVOM on 200 ohm scale. • Disconnect boost solenoid connector and measure the solenoid resistance. • Is resistance between 65 and 110 ohms?	Yes ▶	CONNECT BOOST solenoid. GO to **KN5**.
	No ▶	REPLACE BOOST solenoid. RERUN Quick Test.
KN5 CHECK VOLTAGE OF VPWR CIRCUIT		
• Key On, Engine Off. • DVOM on 20V scale. • Measure voltage between VPWR circuit of boost solenoid vehicle harness connector and battery ground. • Is voltage greater than 10.5 volts?	Yes ▶	GO to **KN6**.
	No ▶	SERVICE harness open circuit. RERUN Quick Test.

Turbo Boost

Pinpoint Test

KN

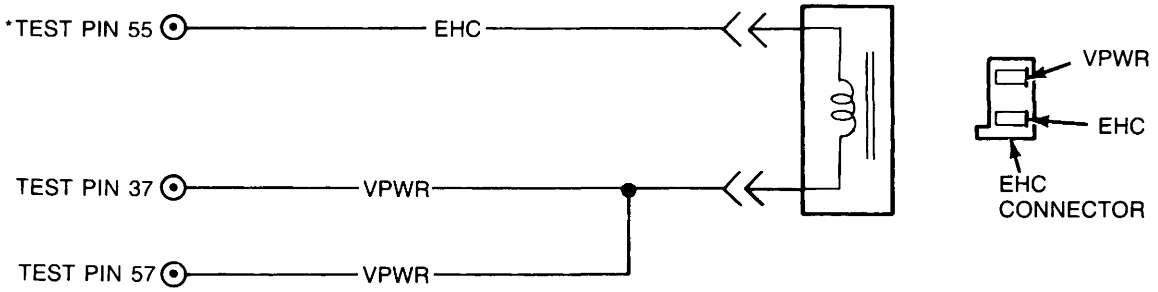
TEST STEP	RESULT ▶	ACTION TO TAKE
KN6 CHECK CONTINUITY OF BOOST CIRCUIT		
○ Key Off, wait 10 seconds. ○ Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. ○ Connect Breakout box to harness. Leave processor disconnected. ○ DVOM on 200 ohm scale. ○ Measure resistance between test Pin 31 at the Breakout box and boost circuit at vehicle harness connector. ○ Is resistance less than 5 ohms?	Yes ▶ No ▶	GO to **KN7**. SERVICE open circuit. RERUN Quick Test.
KN7 CHECK FOR SHORT TO GROUND		
○ Key Off, wait 10 seconds. ○ Leave Breakout box installed and processor disconnected. ○ Disconnect boost solenoid. ○ DVOM on 200,000 ohm scale. ○ Measure resistance between test Pin 31 and test Pins 40, 46 and 60 at the Breakout box. ○ Is resistance greater than 10,000 ohms?	Yes ▶ No ▶	GO to **KN8**. SERVICE short to ground, RERUN Quick Test.
KN8 CHECK FOR SHORT TO POWER		
○ Key Off, wait 10 seconds. ○ DVOM on 200,000 ohm scale. ○ Leave Breakout box installed and processor disconnected. ○ Boost solenoid disconnected. ○ Measure resistance between Pin 31 and test Pins 37 and 57 at the Breakout Box. ○ Is resistance greater than 10,000 ohms?	Yes ▶ No ▶	REPLACE processor. RERUN Quick Test. SERVICE short to power. RERUN Quick Test. If symptom is still present, REPLACE processor.

Exhaust Heat Control (EHC)

Pinpoint Test

KP

KP



*TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9687-A

STOP-WARNING

You should enter this Pinpoint Test only when a service code 89 is received in Quick Test Step 3.0 or when directed here from Diagnostics by Symptom in the Engine Supplement Section.

This Pinpoint Test is intended to diagnose only the following:

- Exhaust Heat Solenoid
- Vacuum Routing

Exhaust Heat Control (EHC) | Pinpoint Test | KP

TEST STEP		RESULT ▶	ACTION TO TAKE
KP1	ENTER OUTPUT STATE CHECK (REFER TO APPENDIX)		
	NOTE: Do not use STAR tester for this Step, use VOM/DVOM. • Key Off, wait 10 seconds. • DVOM on 20V scale. • Connect DVOM negative test lead to STO at the Self-Test connector and positive test lead to battery positive. • Jumper STI to signal return at the Self-Test connector. • Perform Key On, Engine Off Self-Test until the completion of the Continuous Test Codes. • DVOM will indicate zero volts when test is complete. • Depress and release the throttle. • Did DVOM reading change to a high voltage reading?	Yes ▶	REMAIN in Output State Check. GO to **KP2**.
		No ▶	DEPRESS throttle to WOT and release. If STO voltage does not go high, GO to Pinpoint Test Step **Q40**. Leave equipment hooked up.
KP2	CHECK EHC SOLENOID ELECTRICAL OPERATION		
	• DVOM on 20V scale. • Measure voltage between VPWR and EHC circuit at EHC solenoid. • While observing DVOM, depress throttle several times to cycle output on and off. • Does EHC output cycle on and off?	Yes ▶	GO to **KP3**.
		No ▶	GO to **KP5**.
KP3	CHECK EXHAUST HEAT SOLENOID FOR VACUUM CYCLING		
	• Install vacuum pump to the exhaust heat solenoid vacuum supply port and install a vacuum gauge to the output port. Apply 6 in. Hg minimum. • Does the vacuum output cycle On and Off while depressing and releasing the throttle? **NOTE: Maintain vacuum at source.**	Yes ▶	GO to **KP4**.
		No ▶	REPLACE solenoid. RERUN Quick Test.

Exhaust Heat Control (EHC)

Pinpoint Test

KP

TEST STEP	RESULT ►	ACTION TO TAKE
KP4 CHECK MANIFOLD VACUUM LINES FOR BLOCKAGE OR LEAKS		
• With vacuum lines disconnected at exhaust heat solenoid, check for vacuum. • Start engine. • Is vacuum present?	Yes ►	EEC-IV system OK. REFER to Section 3 for exhaust heat diagnostics.
	No ►	SERVICE vacuum source blockage or leak. RERUN Quick Test.
KP5 MEASURE EHC SOLENOID RESISTANCE		
• Key Off, wait 10 seconds. • DVOM on 200 ohm scale. • Disconnect exhaust heat solenoid connector and measure solenoid resistance. • Is resistance between 50 and 100 ohms?	Yes ►	CONNECT exhaust heat solenoid. Go to **KP6**.
	No ►	REPLACE exhaust heat solenoid. RERUN Quick Test.
KP6 CHECK VOLTAGE OF VPWR CIRCUIT		
• Key On, Engine Off. • DVOM on 20V scale. • Measure voltage between VPWR at the EHC solenoid vehicle harness connector circuit and ground. • Is voltage reading 10.5 volts or greater?	Yes ►	GO to **KP7**.
	No ►	SERVICE harness open circuit. RERUN Quick Test.
KP7 CHECK CONTINUITY OF EHC CIRCUIT		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Connect Breakout box to harness. Leave processor disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 55 at the Breakout box and EHC circuit at vehicle harness connector. • Is resistance reading 5 ohms or greater?	Yes ►	SERVICE harness open circuit. RERUN Quick Test.
	No ►	GO to **KP8**.

Exhaust Heat Control (EHC) | Pinpoint Test | KP

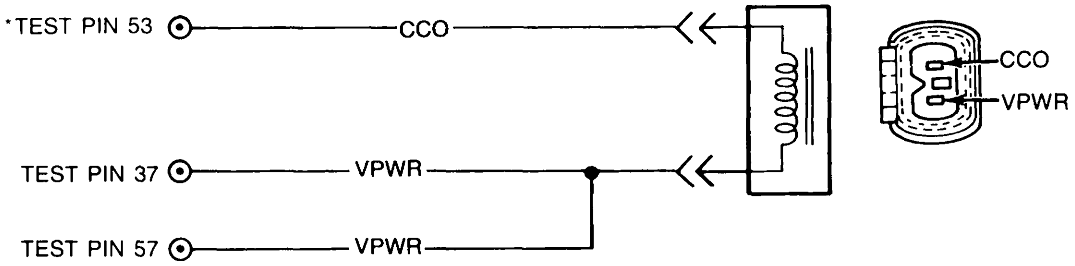
TEST STEP	RESULT ▶	ACTION TO TAKE
KP8 CHECK FOR SHORT TO GROUND		
○ Key Off, wait 10 seconds. ○ Leave Breakout box installed and processor disconnected. ○ Disconnect EHC solenoid. ○ DVOM on 200,000 ohm scale. ○ Measure resistance between test Pin 55 and test Pins 40, 46 and 60 at Breakout box. ○ Are resistance readings 10,000 ohms or greater?	Yes ▶ No ▶	GO to **KP9**. SERVICE short to ground. RERUN Quick Test.
KP9 CHECK FOR SHORT TO POWER		
○ Key Off, wait 10 seconds. ○ DVOM on 200,000 ohm scale. ○ Leave Breakout box installed and processor disconnected. ○ EHC solenoid disconnected. ○ Measure resistance between test Pin 55 and test Pins 37 and 57 at Breakout box. ○ Is the resistance reading 10,000 ohms or greater?	Yes ▶ No ▶	REPLACE processor. RERUN Quick Test. SERVICE short to power. RERUN Quick Test. If code is repeated, REPLACE processor.

Converter Clutch Override (CCO)

Pinpoint Test

KR

KR



*TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9688-C

STOP-WARNING

You should enter this Pinpoint Test only when a service code 88 or 89 is received in Quick Test Step 3.0.

This Pinpoint Test is intended to diagnose only the following:

- Harness Circuits: CCO and V PWR.
- CCO Solenoid.
- Processor Assembly.

TEST STEP	RESULT ▶	ACTION TO TAKE
CODE 89 PRESENT		
KR1 MEASURE CCO SOLENOID RESISTANCE		
• Key Off, wait 10 seconds. • DVOM on 200 ohm scale. • Disconnect CCO solenoid connector and measure solenoid resistance. • Is resistance reading between 26 and 40 ohms?	Yes ▶	CONNECT CCO solenoid. GO to **KR2**.
	No ▶	REPLACE CCO solenoid. RERUN Quick Test.

Converter Clutch Override (CCO)

Pinpoint Test

KR

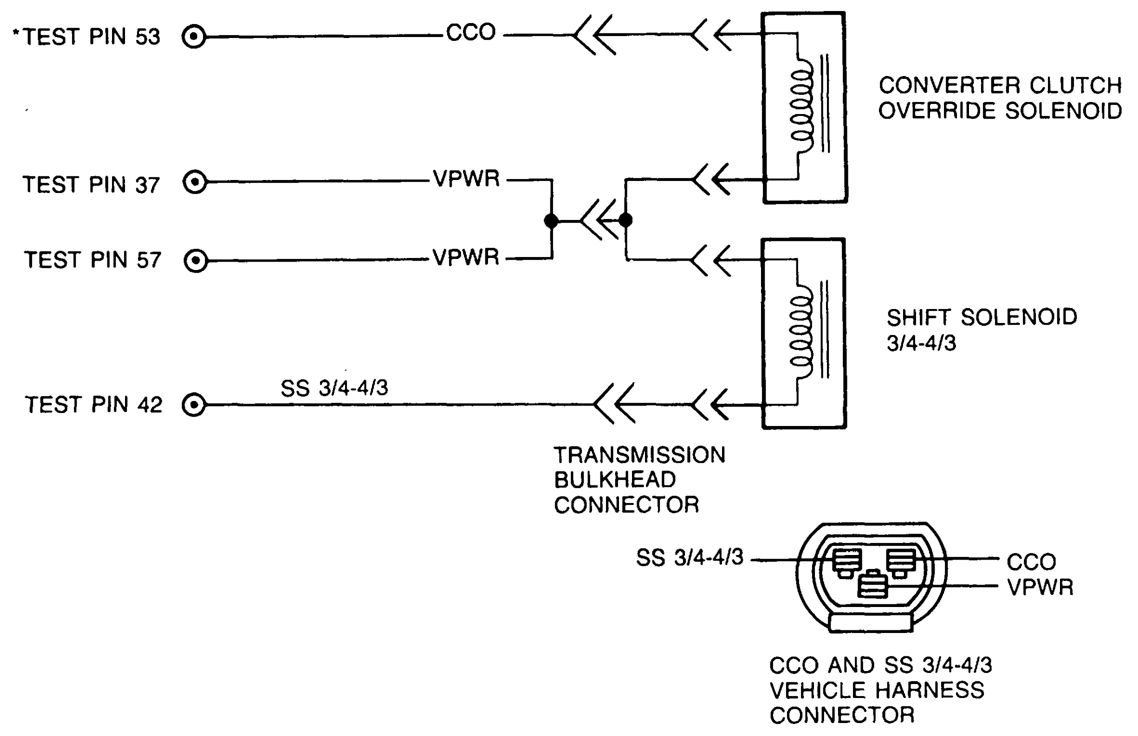
TEST STEP	RESULT ▶	ACTION TO TAKE
KR2 CHECK VOLTAGE OF VPWR CIRCUIT ⊙ Key On, Engine Off. ⊙ DVOM on 20V scale. ⊙ Measure voltage at the CCO solenoid connector between VPWR circuit and battery ground. ⊙ Is voltage reading less than 10.5 volts?	Yes ▶	SERVICE harness open circuit. RERUN Quick Test.
	No ▶	GO to **KR3**.
KR3 CHECK CONTINUITY OF CCO CIRCUIT ⊙ Key Off, wait 10 seconds. ⊙ Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. ⊙ Connect Breakout box to harness. Leave processor disconnected. ⊙ DVOM on 200 ohm scale. ⊙ Measure resistance between test Pin 53 at the Breakout box and CCO circuit at the solenoid vehicle harness connector. ⊙ Is resistance reading less 5 ohms?	Yes ▶	GO to **KR4**.
	No ▶	SERVICE harness open circuit. RERUN Quick Test.
KR4 CHECK FOR SHORT TO GROUND ⊙ Key Off, wait 10 seconds. ⊙ Leave Breakout box installed and processor disconnected. ⊙ Disconnect CCO solenoid. ⊙ DVOM on 200,000 ohm scale. ⊙ Measure resistance between test Pin 53 and test Pins 40, 46 and 60 at Breakout box. ⊙ Are all resistance readings 10,000 ohms or greater?	Yes ▶	GO to **KR5**.
	No ▶	SERVICE short to ground. RERUN Quick Test.
KR5 CHECK FOR SHORT TO POWER ⊙ Key Off, wait 10 seconds. ⊙ DVOM on 200,000 ohm scale. ⊙ Leave Breakout box installed and processor disconnected. ⊙ CCO solenoid disconnected. ⊙ Measure resistance between test Pin 53 and test Pins 37 and 57 at Breakout box. ⊙ Are all resistance readings 10,000 ohms or greater?	Yes ▶	REPLACE processor. RERUN Quick Test.
	No ▶	SERVICE short to power. RERUN Quick Test. If code is still present, REPLACE processor.

Converter Clutch Override (CCO) and Shift Solenoid 3/4-4/3 (SS 3/4-4/3)

Pinpoint Test

KS

KS


*TEST PIN 53
CCO
CONVERTER CLUTCH OVERRIDE SOLENOID
TEST PIN 37
VPWR
TEST PIN 57
VPWR
SHIFT SOLENOID 3/4-4/3
TEST PIN 42
SS 3/4-4/3
TRANSMISSION BULKHEAD CONNECTOR
SS 3/4-4/3
CCO
VPWR
CCO AND SS 3/4-4/3 VEHICLE HARNESS CONNECTOR

***TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.**

A9914-A

STOP-WARNING

You should enter this Pinpoint Test only when a service code 85 or 88 are received in Quick Test Step 3.0.

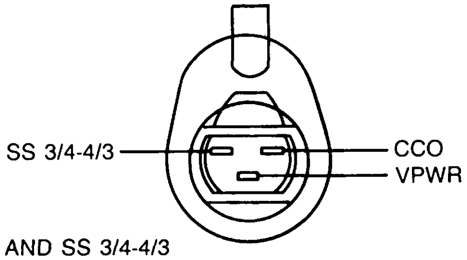
This Pinpoint Test is intended to diagnose only the following:

- Harness Circuits: CCO SS 3/4-4/3 and V PWR.
- CCO Solenoid.
- Shift Solenoid 3/4-4/3.
- Processor Assembly.

Converter Clutch Override (CCO) and Shift Solenoid 3/4-4/3 (SS 3/4-4/3)

Pinpoint Test

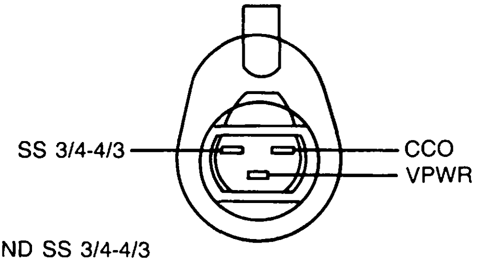
KS

TEST STEP	RESULT ▶	ACTION TO TAKE
CODE 88 PRESENT		
KS1 MEASURE CCO SOLENOID RESISTANCE		
⊙ Key Off, wait 10 seconds. ⊙ DVOM on 200 ohm scale. ⊙ Disconnect CCO solenoid vehicle harness connector and measure solenoid resistance at transmission bulkhead connector. ⊙ Is resistance between 26 and 40 ohms.  CCO AND SS 3/4-4/3 TRANSMISSION BULKHEAD CONNECTOR	Yes ▶	CONNECT CCO solenoid. GO to **KS2**.
	No ▶	GO to Car Shop Manual Volume D, Section 17-08, A4LD transmission diagnosis.
KS2 CHECK VOLTAGE OF VPWR CIRCUIT		
⊙ Key On Engine Off. ⊙ DVOM on 20V scale. ⊙ Measure voltage at the CCO solenoid vehicle harness connector between VPWR circuit and battery ground. ⊙ Is voltage greater than 10.5V?	Yes ▶	GO to **KS3**.
	No ▶	SERVICE harness open circuit. RERUN Quick Test.
KS3 CHECK CONTINUITY OF CCO CIRCUIT		
⊙ Key Off, wait 10 seconds. ⊙ Disconnect processor 60 Pin connector and inspect for damaged pins, corrosin, loose wires. Service as necessary. ⊙ Connect Breakout box to harness. Leave processor disconnected. ⊙ CCO solenoid vehicle harness connector disconnected at transmission bulkhead connector. o DVOM on 200 ohm scale. ⊙ Measure resistance between test Pin 53 at the Breakout box and CCO circuit at the solenoid vehicle harness connector. ⊙ Is resistance less than 5 ohms?	Yes ▶	GO to **KS4**.
	No ▶	SERVICE harness open circuit. RERUN Quick Test.

Converter Clutch Override (CCO) and Shift Solenoid 3/4-4/3 (SS 3/4-4/3)

Pinpoint Test

KS

TEST STEP	RESULT ▶	ACTION TO TAKE
KS4 CHECK FOR SHORT TO GROUND • Key Off, wait 10 seconds. • Leave Breakout box installed and processor disconnected. • CCO solenoid vehicle harness connector disconnected at transmission bulkhead connector. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 53 and test Pins 40, 46 and 60 at Breakout box. • Is resistance greater than 100,000 ohms?	Yes ▶	GO to **KS5**.
	No ▶	SERVICE short to ground. RERUN Quick Test.
KS5 CHECK FOR SHORT TO POWER • Key Off, wait 10 seconds. • DVOM on 200,000 ohm scale. • Leave Breakout box installed and processor disconnected. • CCO solenoid vehicle harness connector disconnected at transmission bulkhead connector. • Measure resistance between test Pin 53 and test Pins 37 and 57 at Breakout box. • Are all resistances greater than 10,000 ohms?	Yes ▶	REPLACE processor. RERUN Quick Test.
	No ▶	SERVICE short to power. RERUN Quick Test. If code is still present, REPLACE processor.
CODE 85 PRESENT **KS10** MEASURE SS 3/4-4/3 RESISTANCE • Key Off, wait 10 seconds. • DVOM on 200 ohm scale. • Disconnect SS 3/4-4/3 vehicle harness connector and measure solenoid resistance at transmission bulkhead connector. • Is resistance between 26 and 40 ohms?  CCO AND SS 3/4-4/3 TRANSMISSION BULKHEAD CONNECTOR A9915-A	Yes ▶	CONNECT SS 3/4-4/3. GO to **KS11**.
	No ▶	GO to Car Shop Manual Volume D, Section 17-08, A4LD transmission diagnosis.

Converter Clutch Override (CCO) and Shift Solenoid 3/4-4/3 (SS 3/4-4/3)

Pinpoint Test

KS

TEST STEP	RESULT ▶	ACTION TO TAKE
KS11 CHECK VOLTAGE OF VPWR CIRCUIT		
○ Key On Engine Off. ○ DVOM on 20V scale. ○ Measure voltage at the SS 3/4-4/3 vehicle harness connector between VPWR circuit and battery ground. ○ Is voltage greater than 10.5V?	Yes ▶	GO to KS12.
	No ▶	SERVICE harness open circuit. RERUN Quick Test.
KS12 CHECK CONTINUITY OF SS 3/4-4/3 CIRCUIT		
○ Key Off, wait 10 seconds. ○ Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. ○ Connect Breakout box to harness. Leave processor disconnected. ○ SS 3/4-4/3 vehicle harness connector disconnected at transmission bulkhead connector. ○ DVOM on 200 ohm scale. ○ Measure resistance between test Pin 53 at the Breakout box and SS 3/4-4/3 circuit at the solenoid vehicle harness connector. ○ Is resistance less than 5 ohms?	Yes ▶	GO to KS13.
	No ▶	SERVICE harness open circuit. RERUN Quick Test.
KS13 CHECK FOR SHORT TO GROUND		
○ Key Off, wait 10 seconds. ○ Leave Breakout box installed and processor disconnected. ○ SS 3/4-4/3 vehicle harness connector disconnected at transmission bulkhead connector. ○ DVOM on 200,000 ohm scale. ○ Measure resistance between test Pin 53 and test Pins 40, 46 and 60 at Breakout box. ○ Is resistance greater than 100,000 ohms?	Yes ▶	GO to KS14.
	No ▶	SERVICE short to ground. RERUN Quick Test.

Converter Clutch Override (CCO) and Shift Solenoid 3/4-4/3 (SS 3/4-4/3)

Pinpoint Test

KS

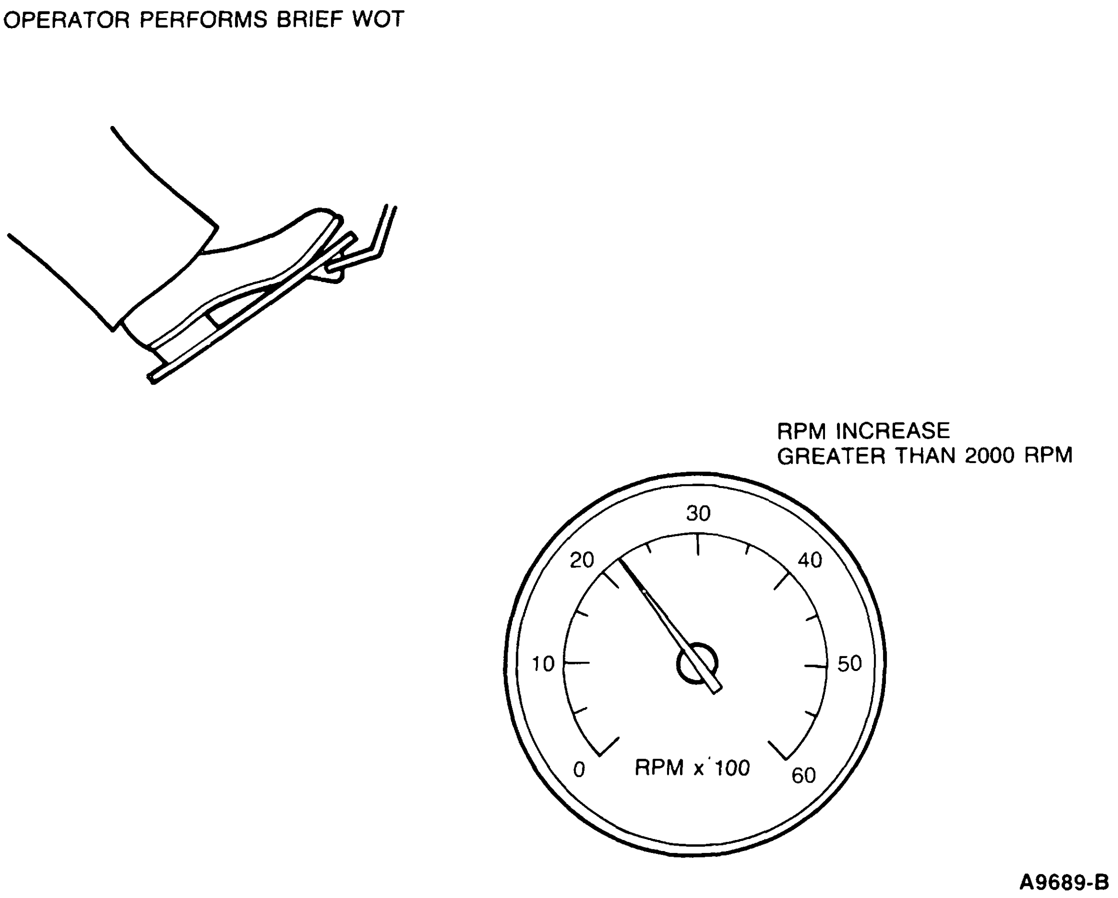
TEST STEP	RESULT ▶	ACTION TO TAKE
KS14 CHECK FOR SHORT TO POWER		
• Key Off, wait 10 seconds. • DVOM on 200,000 ohm scale. • Leave Breakout box installed and processor disconnected. • SS 3/4-4/3 vehicle harness connector disconnected at transmission bulkhead connector. • Measure resistance between Pin 53 and test Pins 37 and 57 at Breakout box. • Are all resistances greater than 10,000 ohms?	Yes ▶	REPLACE processor. RERUN Quick Test.
	No ▶	SERVICE short to power. RERUN Quick Test. If code is still present, REPLACE processor.

Dynamic Response Test

Pinpoint Test

M

M



STOP-WARNING

You should enter this Pinpoint Test only when a service code 77 is received in Quick Test Step 5.0.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Operator did not perform a brief WOT after dynamic response code.
- Mechanical engine problems; engine did not achieve greater than 2000 rpm.

This Pinpoint Test is intended to diagnose only the following:

- Throttle movement (greater than 3/4 throttle).
- Vane Air Flow (greater than 50% open).
- RPM increase (greater than 2000 rpm).

Dynamic Response Test

Pinpoint Test M

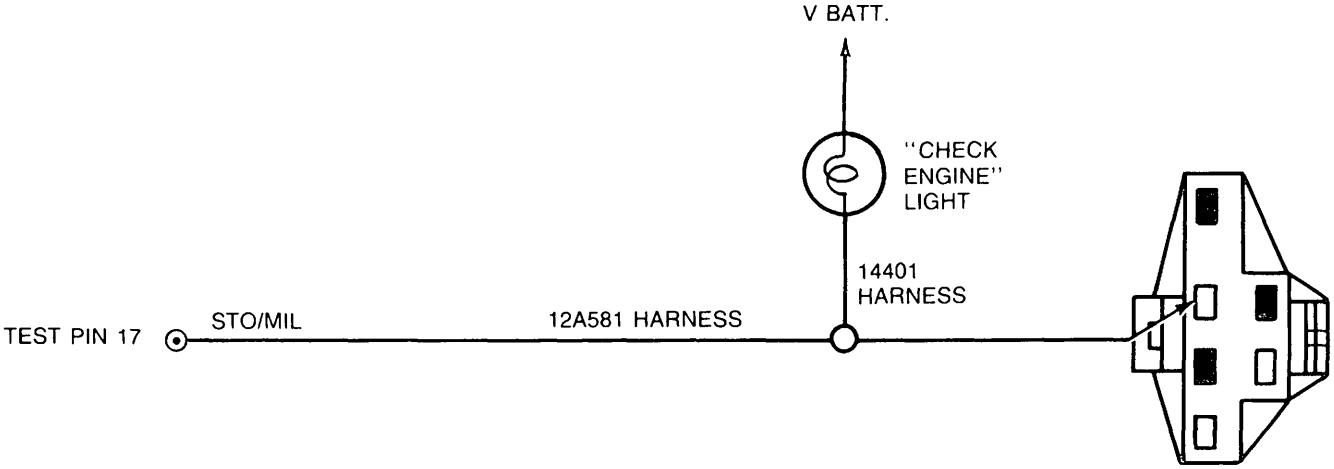
	TEST STEP	RESULT ▶	ACTION TO TAKE
M1	CODE 77: SYSTEM FAILED TO RECOGNIZE BRIEF WOT		

NOTE: A brief snap of the throttle may not be sufficient to pass this test. Be sure to go to WOT and return.

TEST STEP	RESULT ▶	ACTION TO TAKE
(If engine is a 5.0L SEFI, Go to Pinpoint Test HC.) • Repeat Engine Running Test of Quick Test. Be sure operator is familiar with the engine running format which proceeds as follows: — With Self-Test activated restart the engine. — ID Code 2 (0) start of test. — Dynamic response Code 1 (0) perform brief WOT. — Testing over. — Service code output begins. • Is code 77 still present?	Yes ▶	REPLACE processor. RERUN Quick Test.
	No ▶	Dynamic Response Test passed. SERVICE any other service code(s) received as necessary.

"CHECK ENGINE" Light (Malfunction Indicator Light) | Pinpoint Test | ML

ML



A9920-A

STOP-WARNING

You should enter this Pinpoint Test only from Diagnostic by Symptom.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Fuse, bulb or socket.

This Pinpoint Test is intended to diagnose only the following:

- STO/MIL circuit.
- Processor assembly.

“CHECK ENGINE” Light (Malfunction Indicator Light)

Pinpoint Test

ML

TEST STEP	RESULT ▶	ACTION TO TAKE
ML1 CHECK FOR SHORT TO GROUND		
NOTE: If vehicle will not start go to Pinpoint Test Step A1. • **If any Key On Engine Off service codes are present, repair before proceeding. If no codes are outputted, continue with this Test Step.** • Key Off. • Disconnect processor. • Inspect 60 Pin connector for damaged pins/corrosion and service as necessary. • Install Breakout box. Leave processor disconnected. • DVOM on 200 ohm scale. • Connect DVOM between test Pin 17 and test Pin 40. • Is resistance less than 5 ohms?	Yes ▶	SERVICE harness for short to ground (from Pin 17 to Self-Test connector or from Pin 17 to the “CHECK ENGINE” light).
	No ▶	REPLACE processor.
ML5 CONTINUITY CHECK		
NOTE: If vehicle will not start go to Pinpoint Test Step A1. • Key Off. • Disconnect processor. • Inspect 60 Pin connector for damaged pins/corrosion and service as necessary. • Install Breakout box. Leave processor disconnected. • DVOM on 200 ohm scale. • Measure resistance between Pin 17 and STO at the Self-Test connector. • Measure resistance between Pin 17 and the “CHECK ENGINE” light. • Are the resistances less than 5 ohms?	Yes ▶	GO to Pinpoint Test Step **ML6**.
	No ▶	SERVICE OPEN in harness.

"CHECK ENGINE" Light (Malfunction Indicator Light)

Pinpoint Test

ML

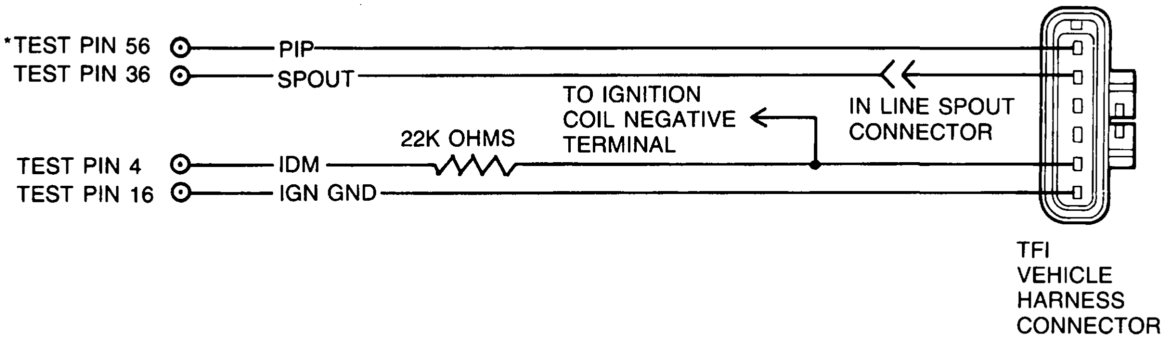
TEST STEP	RESULT ▷	ACTION TO TAKE
ML6 POWER TO BULB		
o Check for power to "CHECK ENGINE" light bulb. o Is there power at the light bulb?	Yes ▷	REPLACE bulb or socket. GO to Pinpoint Test Step ML7.
	No ▷	CHECK fuse and input circuit. GO to Pinpoint Test Step ML7.
ML7 CONFIRM CIRCUIT REPAIR		
o Reconnect processor. o Turn key to run. o Is "CHECK ENGINE" light ON? **NOTE: Refer to the appendix for a detailed description of HOW the "CHECK ENGINE" light (malfunction indicator light) operates.**	Yes ▷	System OK.
	No ▷	REPLACE processor.

Ignition Diagnostic Monitor (IDM)

Pinpoint Test

N

N



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9690-C

STOP-WARNING

You should enter this Pinpoint Test only when a service code 18 is received in Quick Test Step 6.0.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Ignition module.
- Ignition coil.
- Spark plugs and high tension cables.
- Distributor and PIP sensor.

This Pinpoint Test is intended to diagnose only the following:

- Harness circuits: ignition ground, spout, PIP, IDM.

Ignition Diagnostic Monitor (IDM)

Pinpoint Test

N

TEST STEP	RESULT ▷	ACTION TO TAKE
N1 CHECK CONTINUITY OF IDM CIRCUIT		
○ Key Off, wait 10 seconds. ○ Disconnect E-core ignition connector from coil. ○ Disconnect processor and inspect both 60 Pin connectors for damaged pins, corrosion, loose wires. Service as necessary. ○ Connect Breakout box to harness. Leave processor disconnected. ○ DVOM on 200,000 ohm scale. ○ Measure resistance between test Pin 4 at the Breakout box and ignition coil harness connector negative terminal. ○ Is resistance between 20,000 and 24,000 ohms?	Yes ▷	GO to N2.
	No ▷	SERVICE open IDM circuit. RERUN Quick Test. RECONNECT E-core ignition connector to coil.
N2 CHECK FOR SHORT TO GROUND		
○ Key Off, wait 10 seconds. ○ Leave Breakout box installed and processor disconnected. ○ DVOM on 200,000 ohm scale. ○ Measure resistance between test Pin 4 and test Pins 40, 46 and 60 at the Breakout box. ○ Are all resistances above 10,000 ohms?	Yes ▷	RECONNECT E-core ignition connector and processor. GO to N3.
	No ▷	SERVICE short to ground in IDM circuit. RECONNECT E-core ignition connector to coil. RERUN Quick Test.
N3 CHECK TFI MODULE		
○ Key Off, wait 10 seconds. ○ Deactivate Self-Test. ○ Connect VOM or STAR per Quick Test Step 2.0. ○ Enter Engine Running Continuous Monitor Test (as instructed in Quick Test Step 6.0B). ○ Observe VOM or STAR LED for indication of a fault while performing the following: ○ Lightly tap on TFI module (simulate road shock). ○ Wiggle TFI connector. ○ Is a fault indicated?	Yes ▷	DISCONNECT and INSPECT connectors. If connector and terminals are good, GO to Section 15, TFI Ignition Diagnostics.
	No ▷	GO to N4.

Ignition Diagnostic Monitor (IDM)

Pinpoint Test

N

<table>
<tr><th colspan="2">TEST STEP</th><th>RESULT ▶</th><th>ACTION TO TAKE</th></tr>
<tr><td>N4</td><td>CHECK EEC-IV HARNESS</td><td></td><td></td></tr>
<tr><td colspan="2">

While still in continuous monitor test from Step N3, observe VOM or STAR LED for a fault indication while performing the following:
While looking for faults listed in the table below, grasp the harness close to the TFI connector. Wiggle, shake or bend a small section of the EEC-IV system harness while working your way to the dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. Do this test on the circuits listed one at a time if needed to locate a faulty circuit.

<table>
<tr><th>FAULT</th><th>BREAKOUT BOX NO.</th></tr>
<tr><td>PIP shorted to ground or open</td><td>Test Pin 56</td></tr>
<tr><td>Spout shorted to ground</td><td>Test Pin 36</td></tr>
<tr><td>Ign. ground open</td><td>Test Pin 16</td></tr>
<tr><td>IDM open or shorted to ground, power</td><td>Test Pin 4</td></tr>
</table>

Is a fault indicated?

</td><td>Yes ▶
No ▶</td><td>ISOLATE fault and make necessary repairs. RERUN Quick Test.
GO to N5.</td></tr>
<tr><td>N5</td><td>CHECK PROCESSOR AND HARNESS CONNECTORS</td><td></td><td></td></tr>
<tr><td colspan="2">

Key Off, wait 10 seconds.
Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires.
Are connectors and terminals OK?

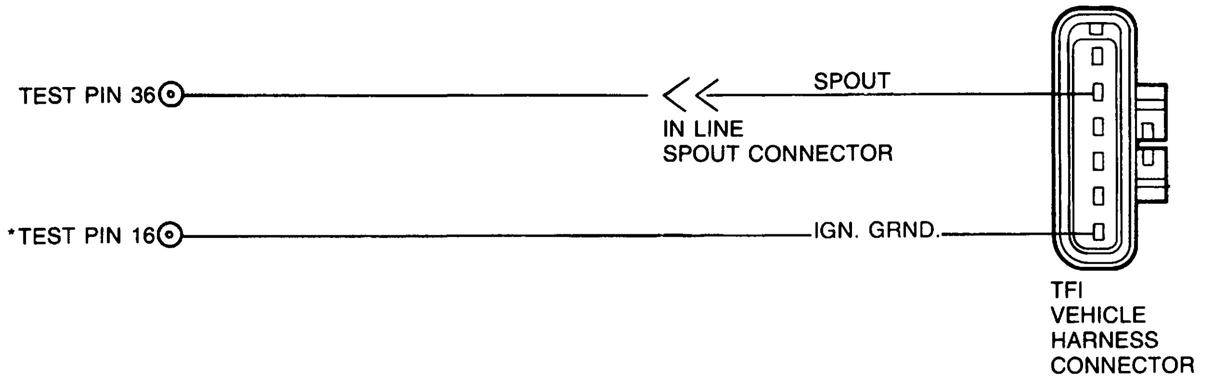
</td><td>Yes ▶
No ▶</td><td>REPLACE processor. Start engine and run for about one minute. RERUN Key On Engine Off Self Test observing continuous codes.
SERVICE as necessary. RECONNECT processor. RERUN Quick Test.</td></tr>
</table>

Spark Timing Check

Pinpoint Test

P

P



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9691-C

STOP-WARNING

You should enter this Pinpoint Test only when directed here from Quick Test Step 4.0 or when a Service Code 18 is received in Quick Test Step 5.0.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- Base Engine.
- PIP Sensor.
- TFI Module.

This Pinpoint Test is intended to diagnose only the following:

- Harness Spout Circuit.
- Base Timing.
- Processor Assembly.

Spark Timing Check

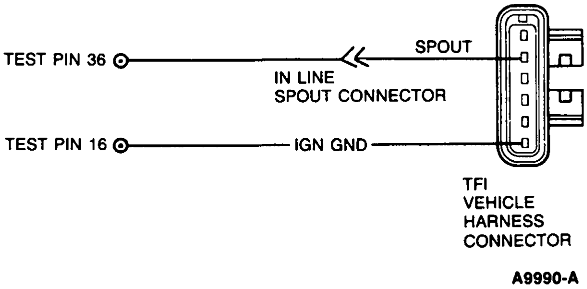
Pinpoint Test

P

TEST STEP	RESULT ▶	ACTION TO TAKE
P1 CHECK SPARK TIMING		
• If Quick Test cannot be run, Go to Q1, otherwise continue with Test Step. NOTE: **Self-Test locks the timing at 20 degrees plus base during code output and for two minutes after the last service code is outputted. Timing check must be made during this time period. Self-Test timing is base +20 degrees (±3 degrees) BTDC. (See VECI decal for base value.)** • Check timing. Record value. • Is timing equal to base plus 20 degrees (±3 degrees)?	Yes ▶	GO to Quick Test Step 5.0.
	No ▶	GO to P2.
P2 CHECK SPARK OUTPUT (SPOUT) CIRCUIT TO THE TFI MODULE		
• Locate spout connector and open this connection. • Start engine. • Check base timing. • Is base timing within ±3 degrees of value on VECI decal?	Yes ▶	RECONNECT spout connector. GO to P3.
	No ▶	Adjust base timing if necessary. REFER to Section 15 for engine timing instructions. After timing is reset, RECONNECT spout and PERFORM Quick Test Step 4.0.
P3 CHECK FOR POWER TO PROCESSOR		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout Box. • Key on, engine off. • DVOM on 20V scale. • Measure voltage between test Pin 37 and test Pin 40 and between test Pin 57 and test Pin 60 at the Breakout box. • Is voltage less than 10.5 volts?	Yes ▶	GO to Pinpoint Test Step B1 except 2.3L EFI TC, 2.5L HSC CFI and 3.0L EFI passenger car; GO to Pinpoint Test Step X1.
	No ▶	GO to P4.

Spark Timing Check

Pinpoint Test **P**

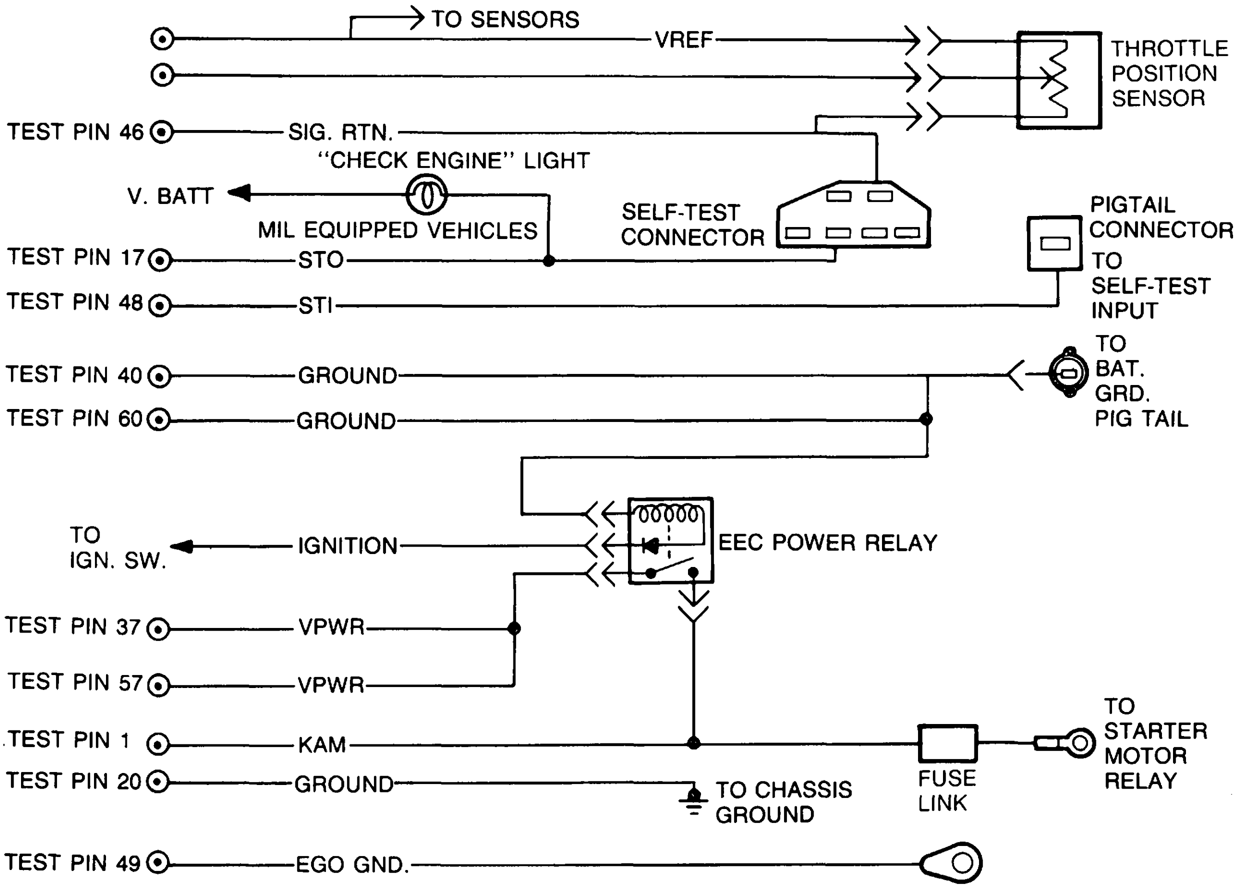
TEST STEP	RESULT ▷	ACTION TO TAKE
P4 CHECK HARNESS FOR CONTINUITY		
○ Key Off, wait 10 seconds. ○ DVOM on 200 ohm scale. ○ Measure resistance between test Pin 36 at the Breakout box and the spout pin at the TFI vehicle harness connector. ○ Is resistance less than 5 ohms?  TEST PIN 36 SPOUT IN LINE SPOUT CONNECTOR TEST PIN 16 IGN GND TFI VEHICLE HARNESS CONNECTOR A9990-A	Yes ▷ No ▷	GO to P5. SERVICE open circuit CHECK timing per P1.
P5 HARNESS CHECK — IGNITION GROUND		
○ Breakout box installed. ○ Key Off. ○ DVOM on 200 ohm scale ○ Measure resistance between test Pin 16 at the Breakout box and the ignition ground at the TFI vehicle harness connector. ○ Is resistance less than 5 ohms?	Yes ▷ No ▷	REPLACE processor. GO to Pinpoint Test Step A7. SERVICE harness as necessary. RERUN Quick Test.

No Codes/Codes Not Listed

Pinpoint Test

Q

Q



***TEST PINS LOCATED ON BREAKOUT BOX.**
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9692-C

STOP-WARNING

You should enter this Pinpoint Test only when directed here from Quick Test Step 3.0, 5.0 or 6.0 or when directed here from Diagnostics by Symptom in the Engine Supplement Section or from a Pinpoint Test Step.

This Pinpoint Test is intended to diagnose only the following:

- Processor.
- Harness Circuits: Signal Return, STO, STI, Ground, VPWR, KAM, VREF, Ignition, NDS, EEC Power Relay.

No Codes/Codes Not Listed

Pinpoint Test Q

TEST STEP	RESULT ▷	ACTION TO TAKE
Q1 CHECK FOR VREF AT TP SENSOR Refer to illustration Q. o Key Off, wait 10 seconds. o DVOM on 20V scale. o Disconnect TP sensor. o Key on, engine off. o Measure voltage between VREF at the TP harness connector and signal return in Self-Test connector. o Is voltage between 4.0 and 6.0 volts?	Yes ▷ No ▷	RECONNECT TP Sensor. GO to Q2. GO to Pinpoint Test Step C1.
Q2 SELF-TEST INPUT CONTINUITY CHECK Refer to illustration Q. o Key Off, wait 10 seconds. o Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. o Install Breakout box, leave processor disconnected. o Set DVOM to 200 ohm scale. o Measure resistance between Self-Test input at the Self-Test single pin connector and test Pin 48 at the Breakout box. o Is resistance less than 5 ohms?	Yes ▷ No ▷	GO to Q3. CORRECT open in circuit.
Q3 SELF-TEST OUTPUT CIRCUIT CONTINUITY CHECK Refer to illustration Q. o Breakout box installed. o DVOM to 200 ohm scale. o Measure resistance between Self-Test output at the Self-Test connector and test Pin 17 at the Breakout box. o Is resistance less than 5 ohms?	Yes ▷ No ▷	GO to Q4. CORRECT open in circuit.

No Codes/Codes Not Listed

Pinpoint Test Q

TEST STEP	RESULT ▶	ACTION TO TAKE
Q4 EGO SENSOR GROUND CONTINUITY CHECK		
Refer to illustration Q. • Breakout box installed. • Key Off. • DVOM on 200 ohm scale. • Measure resistance between EGO ground on engine and test Pin 49 at the Breakout box. • Is resistance less than 5 ohms?	Yes ▶	GO to Q5.
	No ▶	SERVICE EGO sensor ground wire or open circuit bad connection.
Q5 STO SHORT TO GROUND		
• Breakout box installed. • DVOM on 200 ohm scale. • Measure resistance between Self-Test output at Self-Test connector and engine block ground. • Is resistance greater than 5 ohms?	No ▶	REPAIR STO circuit (or "CHECK ENGINE" light circuit on MIL equipped vehicles) for short to ground. RERUN Quick Test.
	Yes ▶	3.0L EFI passenger car GO to Q7. All others GO to Q6.
Q6 INTERMITTENT NDS		
• Key Off. • Breakout box installed. • Processor connected. • Connect DVOM between test Pin 30 and test Pin 40 or 60 at the Breakout box. • Key On Engine Running Self-Test. • Is voltage greater than 1V? **NOTE: Refer to FA for connector orientation.**	Yes ▶	SERVICE intermittent open in NDS harness, connector or switch. If OK, GO to Quick Test Step 5.0 for appropriate service codes.
	No ▶	GO to Q7.

No Codes/Codes Not Listed

Pinpoint Test

Q

TEST STEP	RESULT	ACTION TO TAKE
Q7 POWER RELAY ALWAYS ON		
o Key Off. o Breakout box installed. o Connect DVOM to test Pin 37 or 57 and to test Pin 40 or 60 at the Breakout box. o Turn key on and off. Wait 10 seconds. o Does voltage change from greater than 10.5V to zero volts?	Yes ▷	If vehicle is equipped with MIL (malfunction indicator light displayed as "CHECK ENGINE" light) or SIL (shift indicator light) GO to Q9. If not, REPLACE the processor. RERUN Quick Test.
	No ▷	GO to Q8.
Q8 VPWR HARNESS SHORT TO POWER		
o Key Off. o Breakout box installed. o EEC Power Relay or Integrated Relay Controller disconnected. o Connect DVOM to test Pin 37 or 57 and to test Pin 40 or 60 at the Breakout box. o Is voltage greater than 10.5V?	Yes ▷	REPAIR VPWR harness short to power. RERUN Quick Test.
	No ▷	REPLACE EEC Power Relay or Integrated Relay Controller. RERUN Quick Test.
Q9 MIL AND/OR SIL EQUIPPED VEHICLES		
o Are any of these conditions present?		
o Shift indicator light: — Always ON	▷	GO to KL1.
— Always OFF	▷	GO to KL1.
o Malfunction indicator light: — Always ON	▷	GO to ML1.
— Always OFF	▷	GO to ML5.
o Shift and malfunction indicator lights functioning normally.	▷	REPLACE the processor. RERUN Quick Test.

Continuous Test Code 15

Pinpoint Test

Q

TEST STEP	RESULT ▶	ACTION TO TAKE
Q10 CONDITIONS FOR CONTINUOUS CODE 15		
• Power interruption to Keep Alive Memory (KAM) Pin 1 may result in a service code being outputted.* • Clear continuous memory codes (use procedure described in Quick Test Step 6). • Repeat Quick Test Step 3.0 through Continuous memory code output. • Code 15 present on retest? *NOTE: **Anytime power is interrupted to the processor, for example when installing a Breakout box, a code 15 may be outputted the first time Self-Test is run after restoration of power. Repeat Self-Test to ensure correct diagnosis.**	Yes ▶ No ▶	GO to Q11. Test complete.
Q11 INSPECT ENGINE COMPARTMENT WIRING FOR PROPER ROUTING		
• Are any EEC components or EEC wiring close to ignition components or wires (High Electrical Energy Sources)? If EEC wiring close, reroute and rerun Quick Test. • Is code 15 still present?	Yes ▶ No ▶	GO to Q12. Test complete.
Q12 CHECK POWER CIRCUIT TO KEEP ALIVE MEMORY		
• Key Off, wait 10 seconds. • Disconnect processor and inspect both 60 Pin connectors. • Connect Breakout box to harness, leave processor disconnected. • DVOM on 20V scale. • Connect positive test lead to test Pin 1 and negative test lead to test Pin 40 or 60 at the Breakout box. • Key On. • Is voltage reading less than 10.5 volts?	Yes ▶ No ▶	SERVICE open to KAM circuit. RERUN Quick Test. REPLACE processor. RERUN Quick Test.

Output State Check Not Functioning

Pinpoint Test

Q

TEST STEP	RESULT ▶	ACTION TO TAKE
Q40 CHECK FOR CODES 23, 53, 63 OR 68		
⊙ Key Off, wait 10 seconds. ⊙ Perform Key On Engine Off Self-Test. ⊙ Leave Key On to enter Output State Check. ⊙ Key On Engine Off. Are codes 23, 53, 63 or 68 present?	Yes ▶	GO to Quick Test Step 3.0B and SERVICE appropriate code as instructed.
	Code 11 ▶	GO to Q41.
	No Codes ▶	GO to Q1.
Q41 CHECK THROTTLE LINKAGE		
⊙ Check throttle and throttle linkages for sticking and binding. ⊙ Throttle OK?	Yes ▶	REPLACE TP sensor. RERUN Quick Test.
	No ▶	SERVICE as necessary. RERUN Quick Test.

Processor Power Check

Pinpoint Test Q

TEST STEP	RESULT ▶	ACTION TO TAKE
Q50 CHECK FOR POWER TO PROCESSOR		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box. • Key On Engine Off. • DVOM on 20V scale. • Measure voltage between test Pin 37 and test Pin 40 at the Breakout box and between test Pin 57 and test Pin 60 at the Breakout box. • Is either voltage reading less than10.5 volts?	Yes ▶	2.3L EFI TC, 2.5L CFI and 3.0L EFI passenger car GO to Pinpoint Test **X1**. All others GO to Pinpoint Test **B1**.
	No ▶	REPLACE *processor*. RERUN Quick Test.

Re-Initialization Check

Pinpoint Test

Q

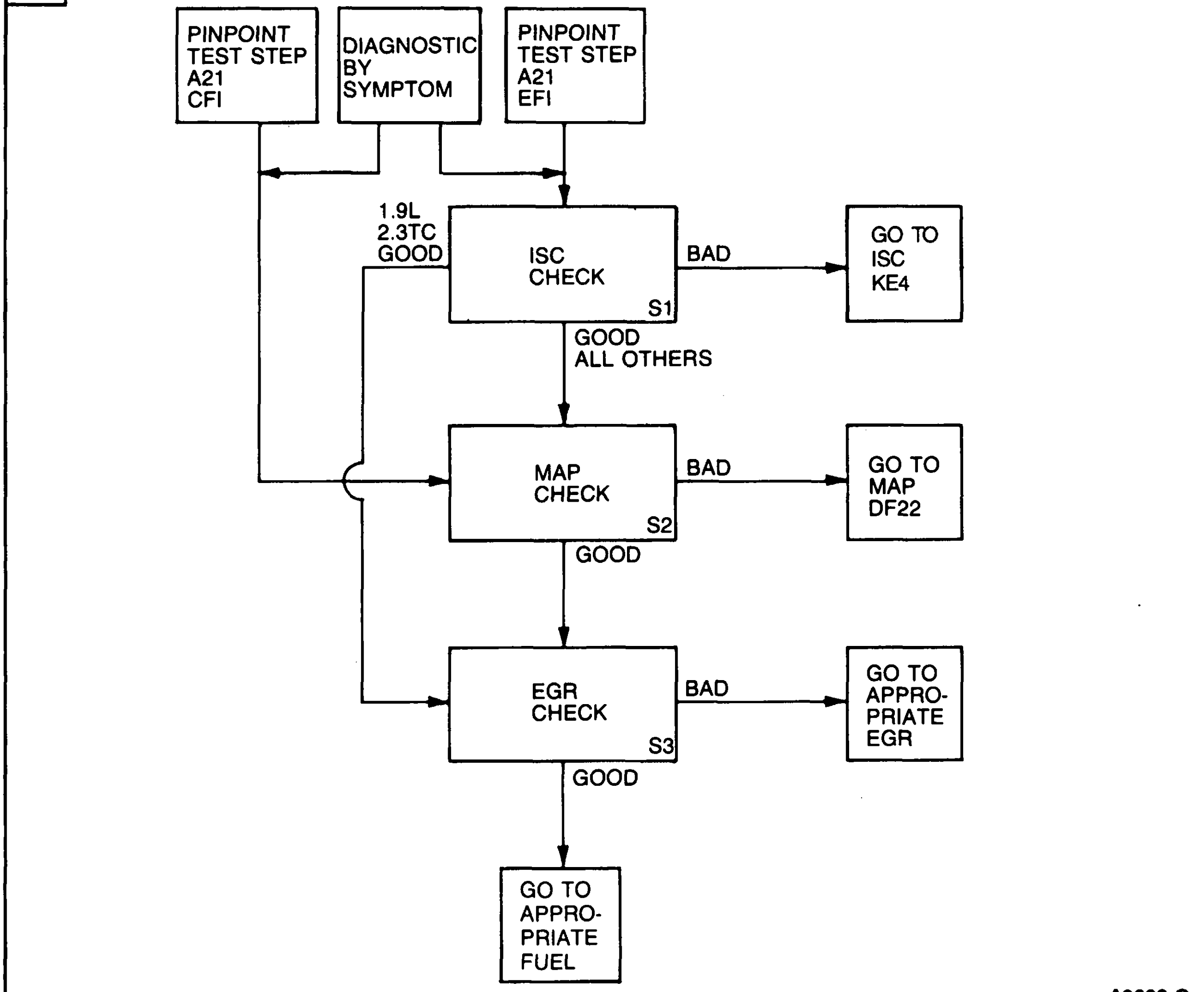
TEST STEP	RESULT ▶	ACTION TO TAKE
Q60 CHECK FOR EEC IV WIRING POSITION		
• Key Off. • Check that the EEC IV wiring and components are greater than 2 inches from secondary ignition wires and ignition coil. • Check that the EEC IV wiring and components are greater than 4 inches from distributor, coil tower, starter motor and its wiring. • Are all above conditions intact?	Yes ▶ No ▶	GO to Q61. SERVICE as necessary, RERUN Quick Test.
Q61 HARNESS CHECK — CASE GROUND		
• Key Off. • Install Breakout box. Leave processor disconnected. • Disconnect processor 60 pin connector. Inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • DVOM on 200 ohm scale. • Measure resistance between test Pin 20 at the Breakout box and chassis ground. • Is the resistance less than 5 ohms?	Yes ▶ No ▶	GO to Q62. SERVICE harness as necessary. RERUN Quick Test.
Q62 DISCONNECT HARNESS — CASE GROUND CHECK		
• Key Off. • Reconnect processor to Breakout box, but disconnect harness from Breakout box. • DVOM on 200 ohm scale. • Measure resistance between test Pin 20 at the Breakout box and metal case of processor. • Is the resistance less than 5 ohms?	Yes ▶ No ▶	GO to Pinpoint Test Step B10. REPLACE Processor. RERUN Quick Test.

System Check

Pinpoint Test

S

S



A9693-C

STOP-WARNING

You should enter this Pinpoint Test only after a code 11 is received in Quick Test Step 3.0, and you have been directed here from EEC-IV No-Start Pinpoint Test Step A21 or Diagnostics by symptom.

This Pinpoint Test is intended only as a Quick Check for the basic functioning of the following:

- ISC Bypass Air System
- MAP System
- EGR System

System Check

Pinpoint Test S

TEST STEP

S1 ISC-BPA CHECK

- If you are here for any reason other than stalls or a no start, go to S2. Except 1.9L EFI and 2.3L EFI TC, go to S3.
- Attempt to start engine at part throttle.
- Will engine run at part throttle?

RESULT ▶	ACTION TO TAKE
Yes, but runs rough ▶	GO to S2.
Yes, and runs smooth ▶	GO to KE4.
No ▶	1.9 EFI and 2.3L EFI TC GO to S3. All others GO to S2.

S2 MAP CHECK

- Key Off.
- Disconnect the MAP sensor from the vehicle harness.
- Connect the MAP tester between the vehicle harness and the MAP sensor.
- Plug MAP tester banana plugs into DVOM.
- Set DVOM to 20V scale.
- Key On.
- Observe DVOM.

Approximate Altitude (Ft.)	Voltage Output (+/−.04V)
0	1.59
1000	1.56
2000	1.53
3000	1.50
4000	1.47
5000	1.44
6000	1.41
7000	1.39

- If MAP sensor is out of limits (voltage output for altitude) GO to DF21.
- Crank engine.
- While cranking, does DVOM reading decrease from the appropriate reading for your altitude listed above?

RESULT ▶	ACTION TO TAKE
Yes ▶	3.0L EFI Truck, GO to Pinpoint Test Step HG1, all others, GO to S3.
No ▶	GO to DF22.

System Check

Pinpoint Test

S

TEST STEP	RESULT ▶	ACTION TO TAKE
S3 EGR CHECK		
NOTE: This test step will attempt to determine if the EGR system is the cause of the current symptom and/or no start. • Disconnect and plug vacuum line at EGR valve. • Inspect EGR valve to ensure valve is closed. • Start or attempt to start engine. • Is symptom eliminated or is no start resolved?	Yes ▶	For 1.9L EFI & 2.3L EFI TC, GO to **KA1**. For 3.8L CFI, 2.3L EFI Car and Truck, GO to **DD11**. For 2.3L HSC CFI, 2.5L HSC CFI, 4.9L EFI, 5.0L EFI, 7.5L EFI Truck and 5.0L SEFI, GO to **DN60**. For 1.9L CFI, 3.0L EFI Passenger Car, and 2.9L EFI Truck, GO to Section 6, EGR Valve Diagnostics.
	No ▶	For 1.9L EFI and 2.3L EFI TC GO to **HA1**. For 1.9L CFI, 2.3L HSC CFI and 2.5L HSC CFI, GO to **HF1**. For 2.9L EFI, 3.0L EFI, and 4.9L EFI, GO to **HG1**. For 3.8L CFI, GO to **HD1**. For 5.0L SEFI, GO to **HC1**. For 2.3L EFI Car and Truck, GO to **HE1**. For 5.0L EFI, 7.5L EFI Truck, GO to **HH1**.

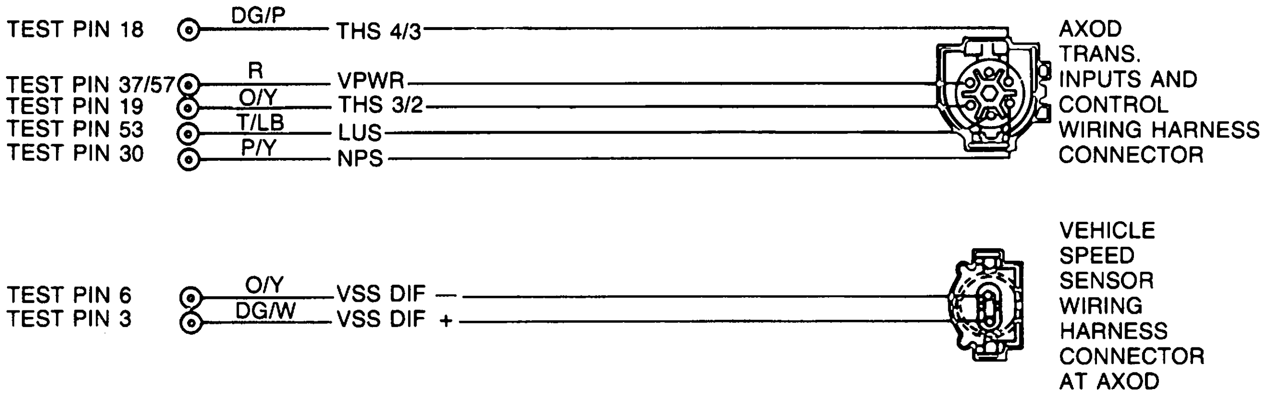
Transmission — AXOD

Pinpoint Test

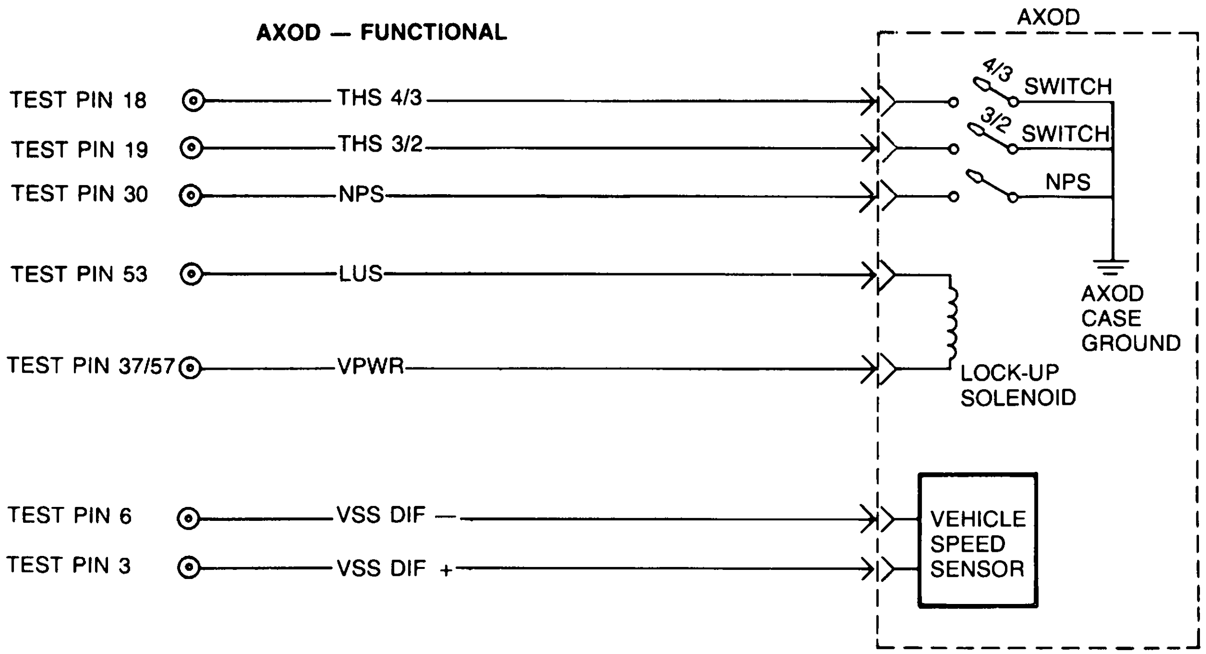
T

T

AXOD — HARNESS CONNECTIONS



AXOD — FUNCTIONAL



A9694-B

Transmission — AXOD

Pinpoint Test

T

STOP-WARNING

You should enter this Pinpoint Test only when service codes 62, 67 and 89 are received in Quick Test Step 3.0 or a service code 62 is received in Quick Test Step 5.0, and/or service codes 29, 39, 57, 59 and 69 received in Quick Test Step 6.0.

This Pinpoint Test is intended to diagnose only the following:

- Harness Circuits: THS 4/3, THS 3/2, LUS, NPS, VSS+, VSS− and VPWR
- Vehicle Speed Sensor
- Processor Assembly

T1

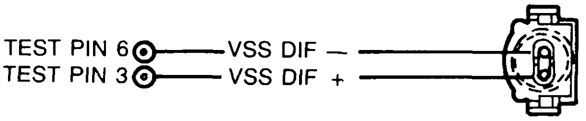
Drive Cycle For Checking AXOD CONTINUOUS CODES

1. Record and zero EEC-IV Self-Test continuous codes.
2. Warm engine to operating temperature.
3. With transmission in D range, lightly accelerate from a stop to 40 mph to achieve third gear. Hold speed and throttle opening (not closed throttle) steady for 15 seconds minimum (30 seconds above 4000 feet altitude).
4. Shift gear selector to OD range and accelerate lightly from 40 to 50 mph to achieve fourth gear. Hold speed and throttle opening (not closed throttle) steady for 15 seconds minimum in fourth gear.
5. With transmission in fourth gear and steady speed and throttle opening (not closed throttle) lightly apply and release brakes (to light brake lamps) and then hold speed and throttle opening steady for an additional 15 seconds minimum.
6. Brake to a stop and remain stopped for 20 seconds minimum with transmission in OD range.
7. Run EEC-IV Self-Test and record continuous codes.

NOTE: All components must be connected when performing this test.

Transmission — AXOD

Pinpoint Test T

TEST STEP	RESULT ▶	ACTION TO TAKE
T2 ATTEMPT TO GENERATE CONTINUOUS CODE 29		
○ Perform Drive Cycle outlined in Test Step T1, then return to this Step. ○ Did continuous code 29 repeat?	Yes ▶	GO to T3.
	No ▶	Unable to duplicate fault at this time. Continuous Code 29. If any other codes are present, RETURN to Quick Test for directions. If none, test is completed.
T3 CONTINUITY OF VEHICLE SPEED SENSOR (VSS) HARNESS		
○ Key Off, wait 10 seconds. ○ Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. ○ Install Breakout box. ○ Processor and VSS disconnected. ○ DVOM on 200 ohm scale. ○ Measure resistance between test Pin 3 at the Breakout box and the VSS vehicle harness connector as shown below. ○ Measure resistance between test Pin 6 at the Breakout box and the VSS vehicle harness connector, as shown below.  A9695-A ○ Are both resistances 5 ohms or less?	Yes ▶	GO to T4.
	No ▶	SERVICE open(s) in VSS harness. REPEAT Test Step T2.

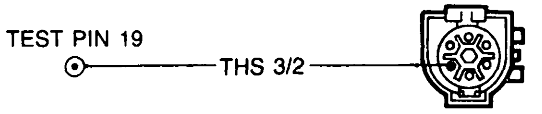
Transmission — AXOD

Pinpoint Test

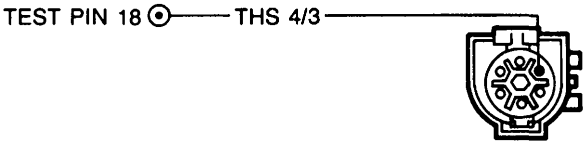
T

TEST STEP	RESULT ▶	ACTION TO TAKE
T4 CHECK VSS HARNESS FOR SHORTS TO POWER OR GROUND		
• Key Off. • Processor disconnected. • VSS disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 3 and test Pins 37, 40 and 6 at the Breakout box. Then measure resistance between test Pin 6 and test Pin 37 at the Breakout box. • Are all readings greater than 1,000 ohms?	Yes ▶	GO to T5.
	No ▶	SERVICE short(s) in VSS harness. REPEAT Test Step T2.
T5 SUBSTITUTE VEHICLE SPEED SENSOR (VSS)		
• Substitute VSS with known good sensor. • Processor and VSS connected. • Perform Drive Cycle outlined in Test Step T1, then return to this Step. • Did continuous code 29 repeat?	Yes ▶	REPLACE processor. REPEAT Test Step T2.
	No ▶	REPLACE VSS. RERUN Quick Test.
T11 ATTEMPT TO GENERATE CONTINUOUS CODE 69		
• Perform Drive Cycle outlined in Test Step T1, then return to this Step. • Did continuous code 69 repeat?	Yes ▶	GO to T12.
	No ▶	Unable to duplicate fault at this time. Continuous Code 69. If any other codes are present, RETURN to Quick Test for directions. If none, test is completed.

Transmission — AXOD | Pinpoint Test | T

TEST STEP	RESULT ▷	ACTION TO TAKE
T12 CHECK CONTINUITY OF THS 3/2 HARNESS CIRCUIT		
o Key Off, wait 10 seconds. o Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. o Install Breakout box. o Processor and AXOD harness disconnected. o DVOM on 200 ohm scale. o Measure resistance between test Pin 19 at the Breakout box and the AXOD vehicle harness connector, as shown below. o Is resistance 5 ohms or less?  A9696-B	Yes ▷ No ▷	GO to T13. SERVICE open in THS 3/2 harness. REPEAT Test Step T11.
T13 CHECK THS 3/2 HARNESS CIRCUIT FOR SHORTS TO POWER		
o Key Off. o Breakout box installed. o Processor disconnected. o AXOD harness disconnected. o DVOM on 200,00 ohm scale. o Measure the resistance between test Pin 19 and test Pin 37 at the Breakout box. o Is resistance greater than 10,000 ohms?	Yes ▷ No ▷	GO to T14. SERVICE short to power in THS 3/2 circuit. REPEAT Test Step T11.
T14 PROCESSOR VERIFICATION		
o Key Off. o Breakout box installed. o Processor connected. o AXOD harness connected. o Jumper test Pin 19 to test Pin 40 at the Breakout box. o Run Key On, Engine Off Quick Test. o Is code 62 present?	No ▷ Yes ▷	REMOVE jumper wire. REPLACE processor. REPEAT Test Step T11. REMOVE jumper wire. GO to Taurus/Sable Shop Manual, Section 17-15 for AXOD Transmission Electrical Component Diagnostics.

Transmission — AXOD | Pinpoint Test | T

TEST STEP	RESULT ▶	ACTION TO TAKE
T21 ATTEMPT TO GENERATE CONTINUOUS CODE 59		
• Perform Drive Cycle outlined in Test Step T1, then return to this Step. • Did continuous code 59 repeat?	Yes ▶	GO to T22.
	No ▶	Unable to duplicate fault at this time. Continuous Code 59. If any other codes are present, RETURN to Quick Test for directions. If none, test is completed.
T22 CHECK CONTINUITY OF THS 4/3 HARNESS CIRCUIT		
• Key Off, wait 10 seconds. • Disconnect processor 60 pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box. • Processor and AXOD harness disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 18 at the Breakout box and the AXOD vehicle harness connector, as shown below.  A9697-A • Is resistance 5 ohms or less?	Yes ▶	GO to T23.
	No ▶	SERVICE open in THS 4/3 harness. REPEAT Test Step T21.

Transmission — AXOD

Pinpoint Test

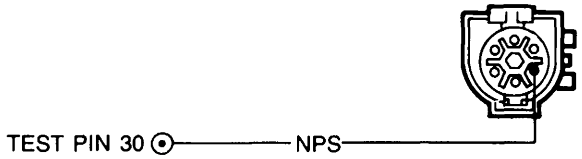
T

TEST STEP		RESULT ▶	ACTION TO TAKE
T23	CHECK THS 4/3 HARNESS CIRCUIT FOR SHORT TO POWER		
	• Key Off. • Breakout box installed. • Processor disconnected. • AXOD harness disconnected. • DVOM on 200,000 ohm scale. • Measure the resistance between Pin 18 and test Pin 37 at the Breakout box. • Is resistance greater than 10,000 ohms?	Yes ▶	GO to T24.
		No ▶	SERVICE short to power to THS 4/3 circuit. REPEAT Test Step T21.
T24	PROCESSOR VERIFICATION		
	• Key Off. • Breakout box installed. • Processor connected. • AXOD harness connected. • Jumper test Pin 18 to test Pin 40 at the Breakout box. • Run Key On Engine Off Quick Test. • Is code 62 present?	No ▶	REMOVE jumper wire. REPLACE processor. REPEAT TEST Step T21.
		Yes ▶	REMOVE jumper wire. GO to Taurus/Sable Shop Manual, Section 17-15 for AXOD Transmission Electrical Component Diagnostics.
T31	ATTEMPT TO GENERATE CONTINUOUS CODE 39		
	NOTE: If continuous code 59 is also present, go directly to T21. • Perform Drive Cycle outlined in Test Step T1, then return to this Step. • Did continuous code 39 repeat?	Yes ▶	GO to Taurus/Sable Shop Manual Section 17-15 for AXOD Transmission Electrical Component Diagnostics.
		No ▶	Unable to duplicate fault at this time. Continuous Code 39. If any other codes are present, RETURN to Quick Test for directions. If none, test is completed.

Transmission — AXOD

Pinpoint Test

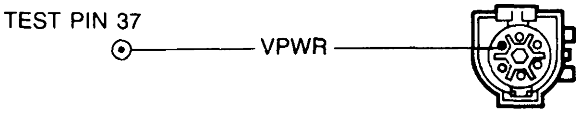
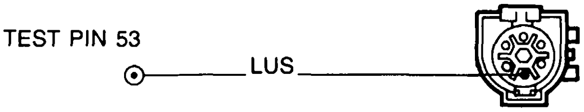
T

TEST STEP	RESULT ▶	ACTION TO TAKE
T41 ATTEMPT TO GENERATE CONTINUOUS CODE 57		
• Perform Drive Cycle outlined in Test Step T1, then return to this Step. • Did continuous code 57 repeat?	Yes ▶	GO to **T42**.
	No ▶	Unable to duplicate fault at this time. Continuous Code 57. If any other codes are present, RETURN to Quick Test for directions. If none, test is completed.
T42 CHECK CONTINUITY OF NPS HARNESS CIRCUIT		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Install Breakout box. • Processor and AXOD harness disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 30 at the Breakout box and the AXOD vehicle harness connector, as shown below.  A9698-A • Is resistance 5 ohms or less?	Yes ▶	GO to Taurus/Sable Shop Manual, Section 17-15 for AXOD Transmission Electrical Component Diagnostic.
	No ▶	SERVICE open in NPS circuit. REPEAT Test Step **T41**.

Transmission — AXOD

Pinpoint Test

T

TEST STEP	RESULT	ACTION TO TAKE
SERVICE CODE 89		
T51 VPWR HARNESS CONTINUITY CHECK		
○ Key Off, wait 10 seconds. ○ Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. ○ Install Breakout box. ○ Processor and AXOD harness disconnected. ○ DVOM on 200 ohm scale. ○ Measure resistance between test Pin 37 at the Breakout box and the AXOD vehicle harness connector, as shown.  A9699-B ○ Is resistance 5 ohms or less?	Yes ▶ No ▶	GO to T52. SERVICE open in VPWR circuit to AXOD. RERUN Quick Test.
T52 LUS HARNESS CONTINUITY CHECK		
○ Key Off. ○ Breakout box installed. ○ Processor and AXOD harness disconnected. ○ DVOM on 200 ohm scale. ○ Mesasure resistance between test Pin 53 at the Breakout box and the AXOD vehicle harness connector, as shown.  A9700-B ○ Is resistance 5 ohms or less?	Yes ▶ No ▶	GO to T53. SERVICE open in LUS harness circuit to AXOD. RERUN Quick Test.

Transmission — AXOD

Pinpoint Test

T

TEST STEP	RESULT ▶	ACTION TO TAKE
T53 CHECK LUS HARNESS FOR SHORTS TO POWER, GROUND		
• Key Off. • Processor disconnected. • AXOD harness disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 53 and test Pins 37 and 40 at the Breakout box. • Are both readings greater than 10,000 ohms?	Yes ▶	GO to T54.
	No ▶	SERVICE shorts in LUS harness. RERUN Quick Test. If code 89 is still present, REPLACE processor. RERUN Quick Test.
T54 TOTAL CIRCUIT RESISTANCE CHECK		
• Key Off. • Breakout box installed. • Processor disconnected. • AXOD transmission harness connected. • DVOM on 200 ohm scale. • Measure the resistance between test Pin 53 and test Pin 57 at the Breakout box. • Is resistance between 20 ohms and 40 ohms?	Yes ▶	REPLACE processor. RERUN Quick Test.
	No ▶	GO to Taurus/Sable Shop Manual, Section 17-15 for AXOD Transmission Electrical Component Diagnostic.
SERVICE CODE 62: KEY ON, ENGINE OFF QUICK TEST		
T61 CHECK FOR CODE 62 IN ENGINE RUNNING SELF-TEST		
• Perform Engine Running Self-Test and record codes. • Is code 62 present?	Yes ▶	Fault is in the 4/3 circuit, GO to T62.
	No ▶	Fault is in the 3/2 circuit, GO to T62.

Transmission — AXOD

Pinpoint Test

T

TEST STEP	RESULT ►	ACTION TO TAKE
SERVICE CODE 62: KEY ON, ENGINE OFF QUICK TEST		
T62 AXOD HARNESS VERIFICATION		
• Key Off. • Disconnect AXOD harness. • Run Key On Engine Off Quick Test. • Is code 62 still present?	Yes ►	GO to \boxed{T63}.
	No ►	GO to Taurus/Sable Shop Manual, Section 17-15 for AXOD Transmission Electrical Component Diagnostics.
T63 CHECK THS 3/2 AND 4/3 HARNESS CIRCUITS FOR SHORT TO GROUND		
• Key Off. • Install Breakout box and disconnect processor. • AXOD harness disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 18 and test Pins 40 and 60 at the Breakout box. • Measure resistance between test Pin 19 and test Pins 40 and 60 at the Breakout box. • Are all resistance readings greater than 10,000 ohms?	Yes ►	REPLACE processor. RERUN Quick Test.
	No ►	SERVICE short(s) to ground. RERUN Quick Test.
T71 SERVICE CODE 62: ENGINE RUNNING SELF-TEST		
• Verify code 62 present in Engine Running Self-Test.	Code 62 present ►	GO to Taurus/Sable Shop Manual, Section 17-15 for AXOD Transmission Electrical Component Diagnostics.
	Code 62 not present ►	Unable to duplicate fault at this time. If any other codes are present, RETURN to Quick Test for directions. If none, then test is complete.

Transmission — AXOD

Pinpoint Test

T

TEST STEP		RESULT ▶	ACTION TO TAKE
T81	SERVICE CODE 67 — CHECK VOLTAGE AT NPS INPUT TO PROCESSOR		
• Key On Engine Off. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box and reconnect processor. • DVOM on 20V scale. • Measure voltage between test Pin 30 and test Pin 46 at the Breakout box. • Is voltage less than 4V?		Yes ▶ No ▶	GO to **T82**. GO to Pinpoint Test **FA4**.
T82	CHECK NPS HARNESS CIRCUIT FOR SHORT TO GROUND		
• Key Off. • Breakout box installed. • Processor and AXOD harness disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 30 and test Pins 40 and 60 at the Breakout box. • Are all readings greater than 10,000 ohms?		Yes ▶ No ▶	GO to **T83**. SERVICE short to ground in NPS circuit. RERUN Quick Test.

Transmission — AXOD

Pinpoint Test

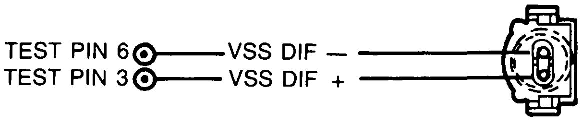
T

TEST STEP	RESULT ▶	ACTION TO TAKE
T83 PROCESSOR VERIFICATION		
• Key Off. • Breakout box installed. • Processor connected. • AXOD harness disconnected. • Run Key On Engine Off Quick Test. • Is code 67 present?	Yes ▶	REPLACE processor. RERUN Quick Test.
	No ▶	GO to Taurus/Sable Shop Manual, Section 17-15 for AXOD Transmission Electrical Component Diagnostics.

Transmission — VSS

Pinpoint Test

T

TEST STEP	RESULT ▶	ACTION TO TAKE
T90 SENSOR CHECK		
• Key Off, wait 10 seconds. • Locate, and disconnect vehicle speed sensor. • DVOM on 2,000 ohm scale. • Measure resistance across vehicle speed sensor. • Is resistance between 190 and 230 ohms?	Yes ▶ No ▶	GO to T91. REPLACE sensor, verify drive complaint was eliminated.
T91 CONTINUITY OF VEHICLE SPEED SENSOR (VSS) HARNESS		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box. • Processor and VSS disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 3 at the Breakout box and the VSS vehicle harness connector as shown below. • Measure resistance between test Pin 6 at the Breakout box and the VSS vehicle harness connector, as shown below.  A9695-A • Are both resistances 5 ohms or less?	Yes ▶ No ▶	GO to T92. SERVICE open(s) in VSS harness.

Transmission — VSS

Pinpoint Test

T

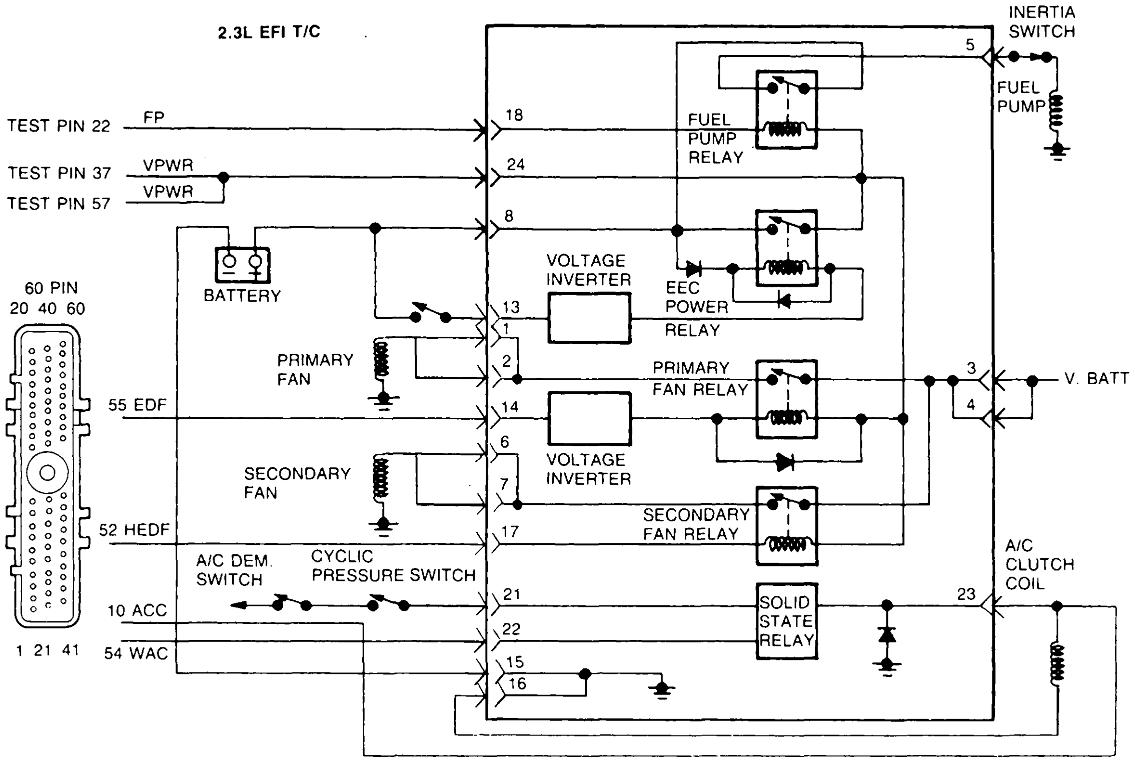
TEST STEP	RESULT ▶	ACTION TO TAKE
T92 CHECK VSS HARNESS FOR SHORTS TO POWER OR GROUND		
○ Key Off. ○ Processor disconnected. ○ VSS disconnected. ○ DVOM on 200,000 ohm scale. ○ Measure resistance between test Pin 3 and test Pins 37, 40 and 6 at the Breakout box. Then measure resistance between test Pin 6 and test Pin 37 at the Breakout box. ○ Are all readings greater than 1,000 ohms?	Yes ▶ No ▶	GO to T93. SERVICE short(s) in VSS harness.
T93 SUBSTITUTE VEHICLE SPEED SENSOR (VSS)		
○ Substitute VSS with known good sensor. ○ Processor and VSS connected. ○ Drive vehicle to verify drive complaint. ○ Was drive complaint eliminated?	Yes ▶ No ▶	REPLACE VSS. REPLACE processor.

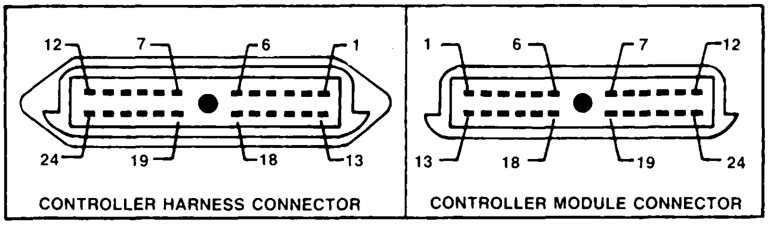
Integrated Relay Controller Module

Pinpoint Test

X

X





A9916-A

Refer to Engine Supplement for Test Pin Usage Chart.

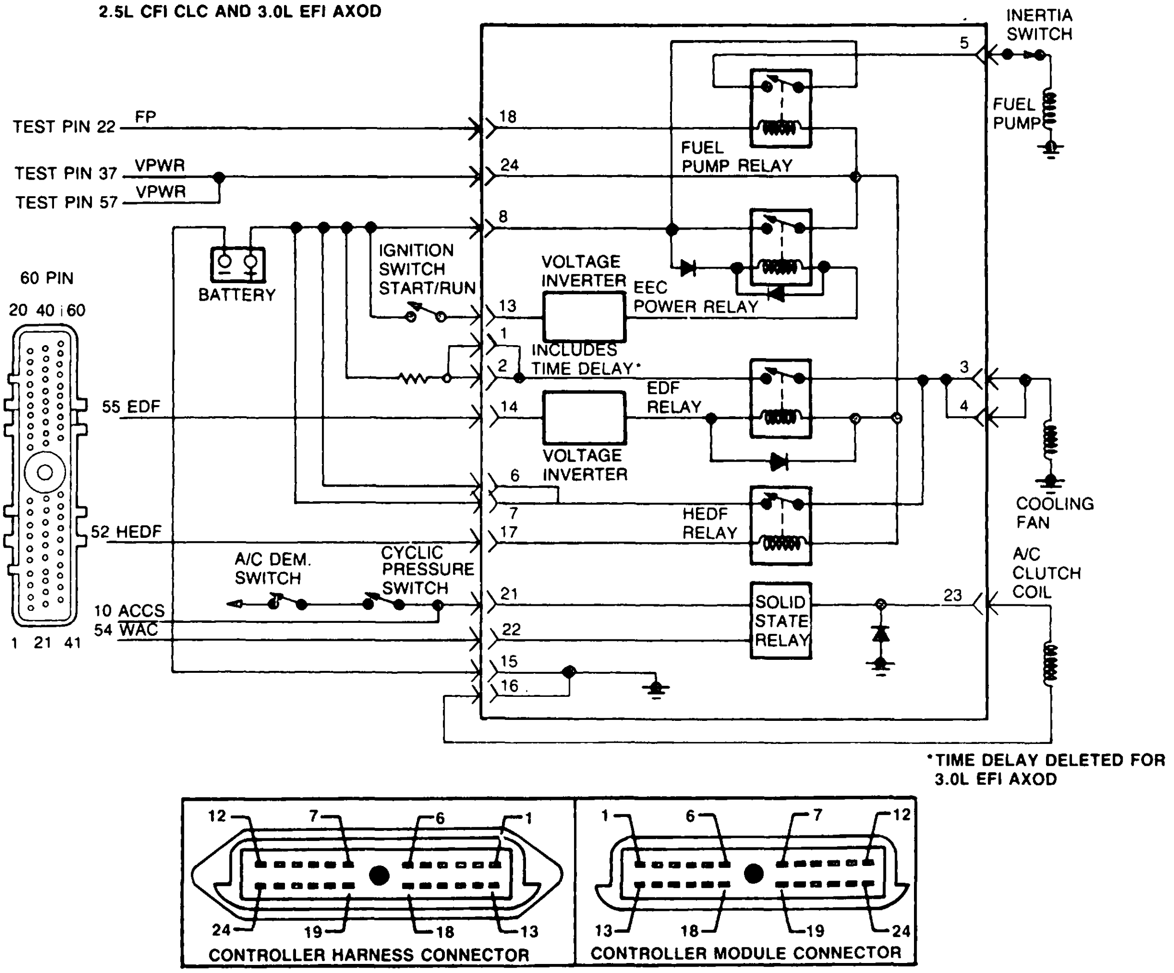
Integrated Relay Controller Module

Pinpoint Test

X

X

2.5L CFI CLC AND 3.0L EFI AXOD



*TIME DELAY DELETED FOR 3.0L EFI AXOD

A9968-A

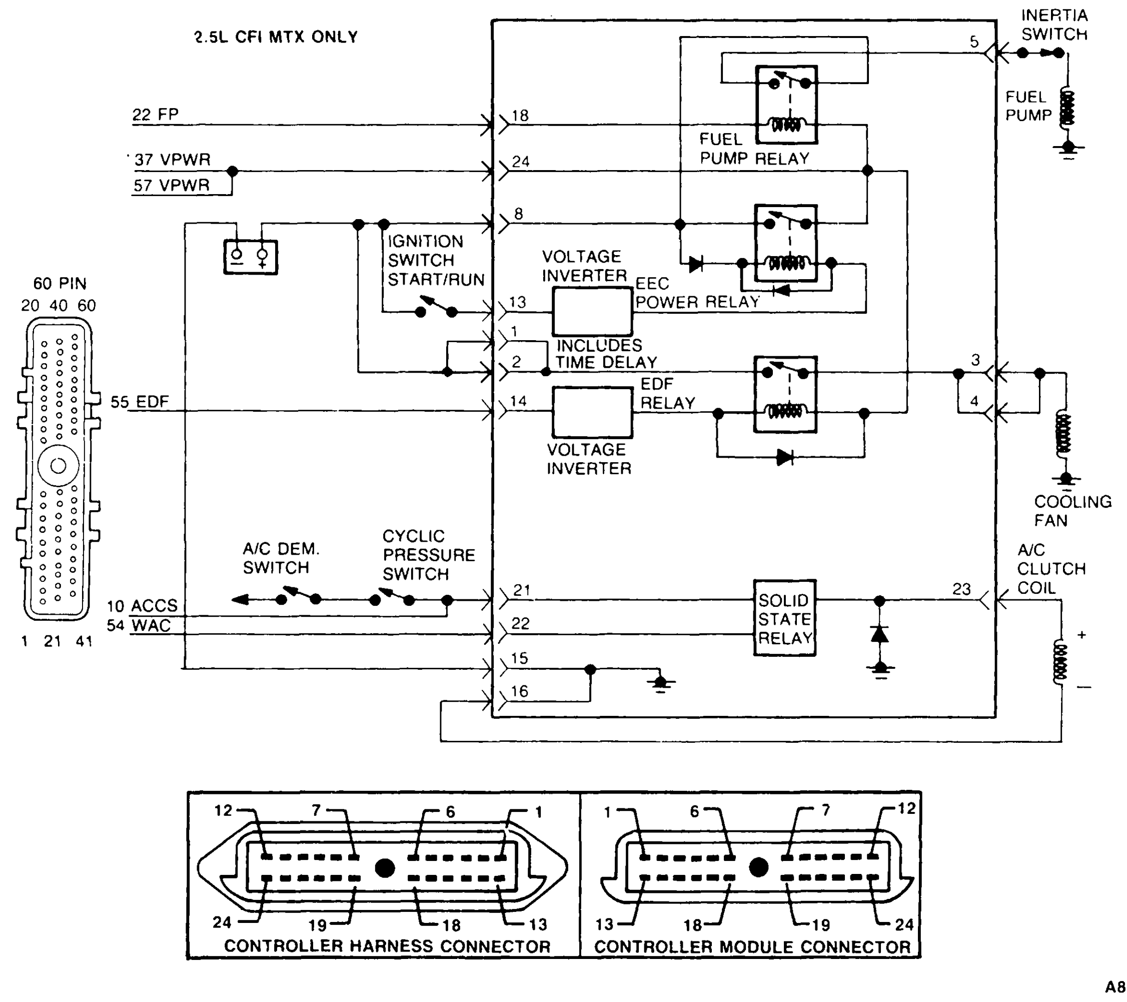
Refer to Engine Supplement for Test Pin Usage Chart.

Integrated Relay Controller Module

Pinpoint Test

X

X



Refer to Engine Supplement for Test Pin Usage Chart.

Integrated Relay Controller Module

Pinpoint Test

X

STOP-WARNING

You should enter this Pinpoint Test only when service code 72, 78, 82, 83, 87 and 88 are received in Quick Test Step 3.0 or you are directed here from Pinpoint Test A, Pinpoint Test C, or Diagnostic By Symptom.

To prevent the replacement of good components, be aware that the following non-EEC area may be at fault:

- Fuel Lines
- Fuel Filters
- Contaminated Fuel
- Fuel Pump
- Ignition Switch
- Battery Cables
- Alternator
- Voltage Regulator
- Ground Straps
- A/C Clutch
- A/C Demand
- Cooling Fan Motor

This pinpoint test is intended to diagnose only the following:

- Integrated Relay Controller Module (within this Pinpoint Named Integrated Controller)
- Battery Voltage
- Power Relay
- EDF Relay
- HEDF Relay
- WAC Relay
- Fuel Pump Relay
- Harness Circuits: V Batt., VPWR, F.P., Ground and Power to Fuel Pump(s), WAC, ACC, ACCS, Cooling Fan Power, A/C Clutch, Key Power, Powers To Integrated Controller
- Processor Assembly
- A/C Demand Switch Input

Integrated Controller | Pinpoint Test | X

TEST STEP	RESULT ▶	ACTION TO TAKE
VEHICLE BATTERY		
X1 BATTERY VOLTAGE CHECK		
• Key On Engine Off. • DVOM on 20V scale. • Measure voltage across battery terminals. • Is voltage 10.5 volts or greater?	Yes ▶ No ▶	GO to X2. SERVICE discharged battery, REFER to Shop Manual, Group 31.
X2 BATTERY POWER GROUND CHECK		
• Key On Engine Off. • Processor connected. • DVOM on 20V range. • Measure voltage between battery negative post and Signal Return circuit in the Self-Test connector. • Is voltage 0.5 volts or greater?	Yes ▶ No ▶	GO to X3. GO to X6.
X3 GROUND FAULT ISOLATION		
• Key Off. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box. • Key On Engine Off. • Processor connected. • DVOM on 20V scale. • Measure voltage between battery negative post and test Pins 40 and 60 at the Breakout box.	Both readings less than 0.5V ▶ One or both readings 0.5V or greater ▶	GO to X4. Circuit(s) with greater than 0.5V has high resistance or open. CORRECT faulty ground circuit. RERUN Quick Test.

Integrated Controller

Pinpoint Test X

TEST STEP	RESULT ▶	ACTION TO TAKE
X4 PROCESSOR GROUND FAULT ISOLATION		
o Breakout box installed. o Key Off, wait 10 seconds. o Processor connected. o DVOM on 200 ohm scale. o Measure resistance between test Pin 46 and test Pin 40 and between test Pin 46 and test Pin 60.	Both reading less than 5 ohms ▶ One or both readings 5 ohms or greater ▶	GO to X5. DISCONNECT processor connector and INSPECT for corrosion, damaged pins, etc. SERVICE as necessary and RETEST. If fault is still present, REPLACE processor. RERUN Quick Test.
X5 HARNESS CHECK (SIGNAL RETURN)		
o Breakout box installed. o Key Off, wait 10 seconds. o Processor connected. o DVOM on 200 ohm scale. o Measure resistance between Pin 46 and Signal Return circuit at Self-Test connector. o Is resistance less than 5.0 ohms?	Yes ▶ No ▶	System OK. RUN Quick Test. CORRECT cause of resistance in the harness Signal Return circuit. RERUN Quick Test.
X6 MEASURE VOLTAGE AND GROUND TO INTEGRATED CONTROLLER		
o Key Off. o Integrated Controller Module disconnected. o DVOM on 20V scale. o Measure voltage at the harness connector to the integrated cntroller from connector Pin 8 (+) to Pin 15 (−). (Refer to illustration X.) o Is voltage 10.5 volts or greater?	Yes ▶ No ▶	GO to X7. GO to X9.

Integrated Controller | Pinpoint Test | X

TEST STEP	RESULT ▶	ACTION TO TAKE
X7 KEY POWER TO INTEGRATED CONTROLLER		
• Integrated Controller disconnected. • DVOM on 20V scale. • Key On. • Measure voltage at the harness connector to the integrated controller from connector Pin 13 (+) to Pin 15 (−). • Refer to illustration X. • Is voltage 10.5 volts or greater?	Yes ▶	GO to **X8**.
	No ▶	SERVICE open between 13 and ignition switch. RECONNECT Integrated Controller. RERUN Quick Test.
X8 MEASURE CONTINUITY OF VPWR		
• Key Off. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Install Breakout box • Leave processor disconnected. • DVOM on 200 ohm scale. • Measure resistance from test Pin 37 and 57 to Integrated Controller harness Pin 24. • Is resistance 5.0 ohms or greater?	Yes ▶	SERVICE open in VPWR circuit. CONNECT Integrated Controller. RERUN Quick Test.
	No ▶	REPLACE Integrated Controller. RERUN Quick Test.
X9 MEASURE CONTINUITY OF POWER GROUND TO INTEGRATED CONTROLLER		
• Key Off. • Integrated Controller disconnected. • DVOM on 200 ohm scale. • Measure resistance from battery negative to Integrated Controller connector Pin 15. • Is resistance 5.0 ohms ore greater?	Yes ▶	SERVICE open in battery ground to Pin 15 (Integrated Controller harness connector). RERUN Quick Test.
	No ▶	SERVICE open in battery positive to Pin 8 (Integrated Controller harness connector). RERUN Quick Test.

Integrated Controller — Pinpoint Test — X

TEST STEP		RESULT ▶	ACTION TO TAKE
X10	CODE 72 OR 78: INTERMITTENT OPEN IN V POWER CIRCUIT		
	NOTE: Code 72 or 78 indicates that while key power was present, V power had an interrupt, resulting in possible stalls, quits on road, or other drive symptoms. Possible Causes: ○ Intermittent open in V power circuit from integrated controller to processor. ○ EEC power relay intermittent malfunction. ○ V battery intermittent open to integrated controller. ○ Intermittent open in key power circuit to integrated controller. ○ Using continuous monitor mode (Key On Engine Off) per Quick Step 6D, observe VOM or STAR LED for indication of a fault while performing the following: ○ Shake, bend and twist harness from integrated controller to the processor, to the ignition switch and to battery positive. ○ Is a fault indicated or does code 72 or 78 reappear in continuous memory if quick test is rerun?	Yes ▶	SERVICE intermittent V power circuit. RERUN Quick Test.
		No ▶	INSPECT component and harness connectors of integrated controller and processor, for loose or damaged pins, corrosion, etc. SERVICE as necessary. If OK, REPLACE integrated controller. RERUN Quick Test.
X11	POWER AT FUEL PUMP(S) CHECK		
	○ Key On Engine Off. ○ Locate fuel pump(s). ○ DVOM on 20V scale. ○ Measure voltage between chassis ground and power-to-pump(s) circuit at fuel pump during crank mode. ○ Is voltage 8.0V or greater during crank?	Yes ▶	GO to Shop Manual, Group 24, Electric Fuel Pump Diagnosis.
		No ▶	GO to X12.
X12	RESISTANCE CHECK OF FUEL PUMP INERTIA SWITCH		
	○ Key Off, wait 10 seconds. ○ Locate and disconnect fuel pump inertia switch. ○ DVOM on 200 ohm scale. ○ Measure the resistance of the fuel pump inertia switch. ○ Is resistance less than 5.0 ohms?	Yes ▶	GO to X13.
		No ▶	REPLACE fuel pump inertia switch. RERUN Quick Test.

Integrated Controller

Pinpoint Test

X

TEST STEP	RESULT ▶	ACTION TO TAKE
X13 POWER-TO-PUMP CIRCUIT CONTINUITY CHECK		
• Key Off. • DVOM on 200 ohm scale. • Integrated Controller disconnected. • Pump(s) disconnected. • Measure resistance from Integrated Controller harness connector Pin 5 to fuel pump(s) harness connector at fuel pump. • Is resistance less than 5.0 ohms?	Yes ▶ No ▶	REPLACE Integrated Controller. RECONNECT all components. RERUN Quick Test. SERVICE open in power-to-pump(s) circuit. RECONNECT Integrated Controller. RERUN Quick Test.
X14 CHECK POWER-TO-PUMP(S) FOR SHORTS TO POWER		
• Key Off. • Integrated Controller disconnected. • Fuel pumps disconnected. • DVOM on 200,000 ohm scale. • Measure resistance from Integrated Controller harness connector Pin 5 to Pin 24 (VPWR) and battery + post.	Any readings less than 10,000 ohms ▶ All readings 10,000 ohms or greater ▶	SERVICE short circuit. RECONNECT all components. ATTEMPT to start vehicle. If vehicle runs, RERUN Quick Test. If vehicle will not run, REPLACE Integrated Controller. RERUN Quick Test. REPLACE Integrated Controller. RERUN Quick Test.
SERVICE CODE: 87		
X15 FUEL PUMP CIRCUIT CONTINUITY		
• Key Off. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires, etc. Service as necessary. • Install Breakout box. • Processor disconnected. • Integrated Controller disconnected. • DVOM on 200 ohm scale. • Measure resistance of fuel pump circuit, from test Pin 22 at the Breakout box to Integrated Controller harness connector Pin 18. • Is resistance less than 5.0 ohms?	Yes ▶ No ▶	GO to **X16**. SERVICE open in fuel pump circuit. RECONNECT processor and controller. RERUN Quick Test.

Integrated Controller | Pinpoint Test | X

TEST STEP		RESULT ▶	ACTION TO TAKE
X16	CHECK FUEL PUMP CIRCUIT FOR SHORTS TO POWER AND GROUND		
	o Key Off. o Breakout box installed. o Processor disconnected. o Integrated Controller disconnected. o DVOM on 200,000 ohm scale. o Measure resistance from test Pin 22 to test Pins 37, 57 and battery positive post and from test Pin 22 to test Pins 40, 60 and battery negative.	All readings 10,000 ohms or greater ▶ Any readings less than 10,000 ohms ▶	GO to **X17**. SERVICE fuel pump circuit shorts to power or ground. RECONNECT all components. RERUN Quick Test. If code 87 is still present, GO to **X17**.
X17	CHECK RESISTANCE OF FUEL PUMP RELAY COIL		
	o Key Off. o Integrated Controller disconnected. o DVOM on 200 ohm scale. o Measure resistance of Integrated Controller from Pin 18 to 24. o Is resistance between 65 and 100 ohms?	Yes ▶ No ▶	REPLACE processor. RECONNECT component. RERUN Quick Test. REPLACE Integrated Controller. RECONNECT components. RERUN Quick Test.
X20	NO FAN, HIGH OR LOW WITH NO CODE 83		
	o Key Off. o Integrated Controller disconnected. o DVOM on 20V scale. o Measure voltage between battery negative post and Pins 1, 2, 6 and 7, respectively at the Integrated Controller harness connector.	All readings 10.5V or greater ▶ Any reading less than 10.5V ▶	GO to **X21**. SERVICE open in battery power circuit. RE-EVALUATE symptom.
X21	FAN MOTOR CHECK		
	o Key Off. o Integrated Controller disconnected. o Jumper Pin 3 to Pin 6 at Integrated Controller harness. o Does fan run?	Yes ▶ No ▶	GO to **X22**. GO to **X23**.

Integrated Controller | Pinpoint Test | X

TEST STEP	RESULT ▶	ACTION TO TAKE
X22 CHECK FAN RUNNING MODE (LOW)		
• Key Off. • Disconnect processor. • Integrated Controller connected. • Key On. • Does fan run at low speed?	Yes ▶ No ▶	GO to X25. CHANGE Integrated Controller. RECONNECT processor and controller. RE-EVALUATE symptom.
X23 MEASURE BATTERY VOLTAGE SUPPLY AT FAN — BYPASSING INTEGRATED CONTROLLER		
• Key Off. • Cooling fan disconnected. • Integrated Controller disconnected. • Jumper Pin 3 to Pin 6 at Integrated Controller harness connector. • DVOM on 20V scale. • Measure voltage at cooling fan harness connector. • Is voltage 8.0 volts or greater?	Yes ▶ No ▶	CHANGE fan motor. RE-EVALUATE symptom. GO to X24.
X24 COOLING FAN GROUND VERIFICATION		
• Key Off. • Cooling fan disconnected. • Integrated Controller disconnected. • Jumper Pin 3 to Pin 6 at Integrated Controller harness connector. • DVOM on 20V scale. • Measure voltage between voltage positive at cooling fan harness connector and negative battery post. • Is voltage 8.0 volts or greater?	Yes ▶ No ▶	SERVICE Open in ground circuit to fan. RECONNECT Integrated Controller. RE-EVALUATE symptom. SERVICE open in power-to-fan circuit from 3 and 4 of Integrated Controller harness connector to cooling fan connector. RECONNECT controller, RE-EVALUATE symptom.

Integrated Controller

Pinpoint Test

X

TEST STEP	RESULT ▶	ACTION TO TAKE
X25 JUMPER HIGH ELECTRIC-DRIVE SIGNAL (HEDF) TO GROUND		
○ Key Off. ○ Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. ○ Install Breakout box. ○ Integrated Controller connected. ○ Processor disconnected. ○ Key On. ○ Jumper test Pin 52 to test Pin 40 at Breakout box. ○ Does fan speed change from low to high?	Yes ▶ No ▶	GO to **X26**. REPLACE Integrated Controller. RECONNECT processor. RE-EVALUATE symptom.
X26 ECT SENSOR CHECK		
○ Reconnect processor. ○ Check engine coolant level. ○ Warm engine to operating temperature before taking ECT resistance measurement. ○ Key Off, wait 10 seconds. ○ Harness disconnected from ECT sensor. ○ DVOM on 200,000 ohm scale. ○ Measure resistance of the ECT sensor. ○ Is the resistance reading between 1500 ohms and 2000 ohms?	Yes ▶ No ▶	REPLACE processor. RECONNECT harness to ECT sensor. RECONNECT Integrated Controllers. RE-EVALUATE symptom. REPLACE ECT sensor. RECONNECT all components. RE-EVALUATE symptom.
X30 SERVICE CODE 83: RESISTANCE CHECK OF HEDF CONTROLLER CIRCUIT		
○ Key Off. ○ Integrated Controller disconnected. ○ DVOM on 200 ohm scale. ○ Measure resistance between Pin 17 and Pin 24 at the Integrated Controller. ○ Is the resistance reading between 50 ohms and 100 ohms?	Yes ▶ No ▶	GO to **X31**. REPLACE controller. RERUN Quick Test.

Integrated Controller

Pinpoint Test

X

TEST STEP	RESULT ▶	ACTION TO TAKE
X31 CHECK HEDF PROCESSOR SIGNAL TO INTEGRATED CONTROLLER FOR OPEN		
• Key Off. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box, leave processor disconnected. • Integrated Controller disconnected. • DVOM On 200 ohms scale. • Measure continuity from test Pin 52 at Breakout box to Pin 17 of Integrated Controller harness. • Is resistance 5 ohms or less?	Yes ▶ No ▶	GO to X32. SERVICE open in HEDF circuit. RECONNECT all components. RERUN Quick Test.
X32 CHECK FOR SHORTS TO GROUND IN THE HEDF CIRCUIT		
• Key Off. • Breakout box installed. • Processor and Integrated Controller disconnected. • DVOM on 200,000 ohm scale. • Measure resistance from test Pin 52 to test Pin 40. • Is resistance 10,000 ohms or less?	No ▶ Yes ▶	GO to X33. SERVICE short to ground in HEDF circuit. RERUN Quick Test.
X33 CHECK FOR SHORTS TO POWER IN THE HEDF CIRCUIT		
• Key Off. • Breakout box installed. • Processor and Integrated Controller disconnected. • DVOM on 200,000 ohms scale. • Measure resistance from test Pin 52 to test Pin 37. • Is resistance 10,000 ohms or less?	No ▶ Yes ▶	REPLACE Processor. RECONNECT all components. RERUN Quick Test. SERVICE short to power. RECONNECT all components. RERUN Quick Test. If code 83 is still present, REPLACE processor. RERUN Quick Test.

Integrated Controller

Pinpoint Test

X

TEST STEP	RESULT ▶	ACTION TO TAKE
X35 LOW SPEED OR HIGH SPEED FAN ALWAYS "ON", NO SERVICE CODE 83 OR 67		
• Key Off. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Breakout box installed, leave processor disconnected. • Disconnect the Integrated Controller. • DVOM on 200 ohm scale. • Measure the resistance between test Pin 55 and controller harness Pin 14. • Is reading 5 ohms or less?	Yes ▶	GO to X36.
	No ▶	SERVICE open in EDF circuit. RECONNECT all components. RE-EVALUATE symptom.
X36 CHECK EDF CIRCUIT FOR SHORTS TO POWER		
• Key Off. • Breakout box installed. • Processor and Integrated Controller disconnected. • DVOM on 200,000 ohm scale. • Measure resistance from test Pin 55 to test Pin 37 and from test Pin 55 to battery positive. • Is resistance 10,000 ohms or less?	Yes ▶	SERVICE short to power in EDF circuit. GO to X37.
	No ▶	GO to X37.
X37 EDF SHORT TO GROUND CHECK		
• Key On. • Breakout box installed. • Processor disconnected. • Integrated Controller connected. • Jumper test Pin 55 to ground test Pin 40 or 60. • Does fan continue to run?	Yes ▶	REPLACE controller RE-EVALUATE symptom.
	No ▶	REPLACE processor. RE-EVALUATE symptom.

Integrated Controller

Pinpoint Test

X

TEST STEP	RESULT ▶	ACTION TO TAKE
X40 NO FAN		
• Key Off. • Integrated Controller disconnected. • DVOM on 20V scale. • Measure voltage between battery negative post and Pin 1 and Pin 2, respectively at the Integrated Controller harness connector. • Is voltage 10.5 volts or greater?	Yes ▶	GO to X41.
	No ▶	SERVICE open in battery power circuit. RE-EVALUATE symptom.
X41 FAN MOTOR CHECK		
• Key Off. • Integrated Controller disconnected. • Jumper Pin 1 to Pin 3 at Integrated Controller harness. • Does fan run?	Yes ▶	GO to X42.
	No ▶	GO to X43.
X42 CHECK FAN RUNNING MODE		
• Key Off. • Disconnect processor. • Integrated Controller connected. • Key On. • Does fan run?	Yes ▶	GO to X46.
	No ▶	GO to X44.
X43 MEASURE BATTERY VOLTAGE SUPPLY AT FAN — BYPASSING INTEGRATED CONTROLLER		
• Key Off • Cooling fan disconnected. • Integrated Controller disconnected. • Jumper Pin 1 to Pin 3 at Integrated Controller harness connector. • DVOM on 20V scale. • Measure voltage at cooling fan harness connector. • Is voltage 8.0 volts or greater?	Yes ▶	CHANGE fan. RE-EVALUATE symptom.
	No ▶	GO to X45.

Integrated Controller

Pinpoint Test

X

TEST STEP	RESULT ▶	ACTION TO TAKE
X44 CHECK EDF CIRCUIT FOR SHORT TO GROUND		
○ Key Off. ○ Processor and controller disconnected. ○ DVOM on 200,000 ohm scale. ○ Measure resistance from Pin 14 to Pin 15 at Integrated Controller harness connector. ○ Is resistance 10,000 ohms or greater?	Yes ▶	CHANGE Integrated Controller. RECONNECT processor and controller. RE-EVALUATE symptom.
	No ▶	SERVICE short to ground in EDF circuit. RECONNECT processor and Integrated Controller. RE-EVALUATE symptom.
X45 COOLING FAN GROUND VERIFICATION		
○ Key Off. ○ Cooling fan disconnected. ○ Integrated Controller disconnected. ○ Jumper Pin 1 to Pin 3 at Integrated Controller harness connector. ○ DVOM on 20V scale. ○ Measure voltage between voltage positive at cooling fan harness connector and negative battery post. ○ Is voltage 8.0 volts or greater?	Yes ▶	SERVICE open in ground circuit to fan. RECONNECT Integrated Controller, RE-EVALUATE symptom.
	No ▶	SERVICE open in power-to-fan circuit from 3 and 4 of Integrated Cointroller harness connector to cooling fan connector. RECONNECT controller. RE-EVALUATE symptom.
X46 ECT SENSOR CHECK		
○ Reconnect processor. ○ Check engine coolant level. ○ Warm engine to operating temperature before taking ECT resistance measurement. ○ Key Off, wait 10 seconds. ○ Harness disconnected from ECT sensor. ○ DVOM on 200,000 ohm scale. ○ Measure resistance of the ECT sensor. ○ Is the resistance reading between 1500 ohms and 2000 ohms?	Yes ▶	REPLACE processor. RECONNECT harness to ECT sensor. RECONNECT Integrated Controller. RE-EVALUATE symptom.
	No ▶	REPLACE ECT sensor. RECONNECT all components. RE-EVALUATE symptom.

Integrated Controller

Pinpoint Test

X

TEST STEP		RESULT ▶	ACTION TO TAKE
X50	CHECK FOR VOLTAGE AT A/C CLUTCH		
	• Key On Engine Off. • A/C demand to A/C. • DVOM on 20V scale. • Check voltage at A/C clutch harness connector. • Is voltage 10.5 volts or greater?	Yes ▶ No ▶	GO to Shop Manual, Group 36, A/C Diagnosis. GO to X51.
X51	CHECK FOR CONTINUITY FROM INTEGRATED CONTROLLER TO A/C CLUTCH		
	• Key Off. • Integrated Controller disconnected. • DVOM on 200 ohm scale. • Measure resistance between Pin 23 of the controller harness and power side of the A/C clutch harness connector and between Pin 16 of the controller harness and ground side of the A/C clutch harness connector. • Are both resistance readings 5 ohms or less?	Yes ▶ No ▶	GO to X52. SERVICE open in power to A/C clutch or ground from A/C clutch. RE-EVALUATE symptom.
X52	ENTER OUTPUT STATE CHECK (REFER TO APPENDIX)		
	NOTE: Do not use STAR tester for this Step, use VOM/DVOM. • Key Off, wait 10 seconds. • Disconnect processor 60 pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Connect Breakout box to harness. Reconnect processor. • DVOM on 20V scale. • Connect DVOM negative test lead to STO and positive test lead to battery positive. • Jumper STI to signal return. • Perform Key On Engine Off Self-Test until the completion of the Continuous Test Codes. • DVOM will indicate zero volts. • Depress and release the throttle. • Did DVOM reading change to a high voltage reading?	Yes ▶ No ▶	REMAIN in Output State Check. GO to X53. DEPRESS throttle to WOT and RELEASE. If STO voltage does not go high, GO to Pinpoint Test Step Q40. LEAVE equipment hooked up.

Integrated Controller

Pinpoint Test X

TEST STEP	RESULT ▶	ACTION TO TAKE
X53 CHECK WAC OUTPUT FOR PROPER ELECTRICAL OPERATION • Key On engine Off. • A/C demand switch to A/C on position. • DVOM on 20V scale. • Connect DVOM positive test lead to test Pin 37 and negative test lead to test Pin 54. • While observing DVOM, depress and release the throttle several times (to cycle output on and off). • Does voltage output cycle high and low?	Yes ▶	2.3L EFI T/C only, GO to X61. All others, GO to X54.
	No ▶	GO to X57.
X54 CHECK FOR VOLTAGE AT A/C CLUTCH SWITCH • Key On Engine Off. • A/C demand switch to A/C on position. • DVOM on 20V scale. • Leave Breakout box installed. • Processor and Integrated Controller connected. • Measure voltage between test Pin 10 and test Pin 40 at Breakout box. • Is voltage 10.5V or greater?	Yes ▶	GO to X55.
	No ▶	GO to X56.
X55 CHECK CONTINUITY OF ACCS TO INTEGRATED CONTROLLER • Key Off, wait 10 seconds. • Processor disconnected. • Integrated Controller disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 10 at Breakout box and Pin 21 at controller harness connector. • Is resistance 5 ohms or less?	Yes ▶	REPLACE Integrated Controller. RE-EVALUATE symptom.
	No ▶	SERVICE open in ACCS circuit. RE-EVALUATE symptom.

Integrated Controller | Pinpoint Test | X

TEST STEP	RESULT ▶	ACTION TO TAKE
X56 CHECK CONTINUITY OF ACCS CIRCUIT		
• Key Off, wait 10 seconds. • A/C demand to A/C. • DVOM on 200 ohm scale. • Measure resistance between test Pin 10 and A/C demand switch. • Is resistance 5 ohms or less?	No ▶	SERVICE open in circuit. RERUN Quick Test.
	Yes ▶	EEC-IV system OK. REFER to Shop Manual, Group 36 A/C Diagnosis.
X57 CHECK CONTINUITY IN WAC TO INTEGRATED CONTROLLER CIRCUIT		
• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Connect Breakout box to harness. Leave processor and Integrated Controller disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 54 and Pin 22 at Integrated Controller harness. • Is resistance 50 ohms or less?	No ▶	SERVICE open in WAC circuit. RE-EVALUATE symptom.
	Yes ▶	GO to **X58**.
X58 CHECK WAC CIRCUIT FOR SHORTS TO GROUND		
• Key Off, wait 10 seconds. • Leave Breakout box installed and processor disconnected. • Integrated Controller disconnected. • DVOM on 200,000 ohm scale. • Measure resistance between test Pin 54 and test Pin 40 and between test Pin 54 and test Pin 46 and between test Pin 54 and battery negative post. • Are all resistance readings 10,000 ohms or greater?	Yes ▶	GO to **X59**.
	No ▶	SERVICE shorts to ground in WAC circuit. RE-EVALUATE symptom.

Integrated Controller

Pinpoint Test

X

TEST STEP		RESULT ▶	ACTION TO TAKE
X59	CHECK WAC CIRCUIT FOR SHORTS TO POWER		
	○ Key Off, wait 10 seconds. ○ Leave Breakout box installed and processor disconnected. ○ Integrated Controller disconnected. ○ DVOM on 200,000 ohm scale. ○ Measure resistance between test Pin 54 and test Pin 37 and between test Pin 54 and battery positive. ○ Are both readings 10,000 ohms or greater?	Yes ▶	GO to **X60**.
		No ▶	SERVICE short to power in WAC circuit and then GO to **X60**.
X60	CHECK FOR VOLTAGE AT A/C CLUTCH		
	○ Key Off, wait 10 seconds. ○ Leave Breakout box installed. ○ Processor disconnected. ○ Integrated Controller connected. ○ A/C clutch disconnected. ○ A/C demand to A/C. ○ Key On Engine Off. ○ DVOM on 20V scale. ○ Measure voltage at A/C clutch harness connection. ○ 10.5V or greater?	Yes ▶	REPLACE processor. RE-EVALUATE symptom.
		No ▶	REPLACE Integrated Controller. RE-EVALUATE symptom.
X61	CHECK FOR VOLTAGE AT A/C INPUT TO CONTROLLER		
	○ Key Off, wait 10 seconds. ○ Leave Breakout box installed. ○ Processor connected. ○ Integrated controller disconnected. ○ Key On Engine off. ○ A/C demand switch to A/C position. ○ DVOM on 20V scale. ○ Measure voltage between Pin 21 at controller harness connector and test Pin 40. ○ Is voltage 10.5V or greater?	Yes ▶	REPLACE Integrated Controller. RE-EVALUATE symptom.
		No ▶	SERVICE open in A/C input circuit to controller. RE-EVALUATE symptom.

Integrated Controller | Pinpoint Test | X

TEST STEP	RESULT ▶	ACTION TO TAKE
X70 NO FAN PRIMARY OR SECONDARY WITH NO CODE 82 OR 88		
• Key Off. • Integrated controller disconnected. • DVOM on 20 volt scale. • Measure voltage between battery negative post and Pins 3 and 4 respectively at controller harness connector. • Are all voltage readings 10.5 volts or greater?	Yes ▶ No ▶	GO to X71. SERVICE open in battery power circuit. RE-EVALUATE symptom.
X71 FAN MOTORS CHECK		
• Key Off. • Integrated controller disconnected. • Jumper Pin 3 to Pin 1 (for primary fan) and Pin 3 to Pin 6 (for secondary fan) at integrated controller harness connector. • Do fans run?	Yes ▶ No ▶	GO to X72. GO to X73.
X72 CHECK FAN RUNNING MODE (LOW)		
• Key Off. • Disconnect processor. • Integrated controller connected. • Key On. • Does primary fan run?	Yes ▶ No ▶	GO to X75. REPLACE Integrated Controller. RECONNECT all components. RE-EVALUATE symptom.
X73 MEASURE BATTERY VOLTAGE SUPPLY AT FANS — BYPASSING INTEGRATED CONTROLLER		
• Key Off. • Cooling fans disconnected. • Integrated controller connector disconnected. • Jumper Pin 3 to Pin 1 (for primary fan) and Pin 3 to Pin 6 (for secondary fan) at integrated controller harness connector. • DVOM on 20 volt scale. • Measure voltage at cooling fan harness connectors.	One or both 8.0 volts or greater. ▶ One or both less than 8.0 volts. ▶	CHANGE fan(s). RE-EVALUATE symptom. GO to X74.

Integrated Controller | Pinpoint Test | X

TEST STEP	RESULT ▶	ACTION TO TAKE
X74 COOLING FAN GROUND VERIFICATION		
• Key Off. • Cooling fan disconnected. • Integrated controller connector disconnected. • Jumper Pin 3 to Pin 1 (for primary fan) and Pin 3 to Pin 6 (for secondary fan) at integrated controller harness connector. • DVOM on 20 volt scale. • Measure voltage between voltage positive at cooling fan harness connector and negative battery post.	One or both 8.0 volts or greater ▶	SERVICE open in ground circuit to fan(s). RECONNECT all components. RE-EVALUATE symptom.
	One or both less than 8.0 volts. ▶	SERVICE open in power circuit to fan(s). RECONNECT all components. RE-EVALUATE symptom.
X75 JUMPER SECONDARY ELECTRIC DRIVE SIGNAL (HEDF) TO GROUND		
• Key Off. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. Service as necessary. • Install Breakout box. • Processor disconnected. • Integrated controller connected. • Jumper test Pin 52 to test Pin 40 at Breakout box. • Key On. • Does secondary fan run?	Yes ▶	GO to X76.
	No ▶	REPLACE Integrated Controller. RECONNECT processor. RE-EVALUATE symptom.
X76 ECT SENSOR CHECK		
• Processor connected. • Check engine coolant level. • Warm engine to operating temperature before taking ECT resistance measurement. • Key Off, wait 10 seconds. • Harness disconnected from ECT sensor. • DVOM on 200,000 ohm scale. • Measure resistance of ECT sensor. • Is resistance between 1500 and 2000 ohms?	Yes ▶	REPLACE processor. RECONNECT all components. RE-EVALUATE symptom.
	No ▶	REPLACE ECT sensor. RECONNECT all components. RE-EVALUATE symptom.

Integrated Controller

Pinpoint Test

X

TEST STEP		RESULT ▶	ACTION TO TAKE
X80	SERVICE CODE 82 OR 88: CHECK EDF PROCESSOR SIGNAL TO INTEGRATED CONTROLLER FOR SHORTS TO GROUND		
	NOTE: If fan is always on with Code 82 OR 88, GO to X82 . • Key Off. • Breakout box installed. • Processor and Integrated Controller disconnected. • DVOM on 200,000 ohm scale. • Measure resistance from test Pin 55 to test Pin 40. • Is resistance 10,000 ohms or less?	Yes ▶	SERVICE short to ground in EDF circuit. RECONNECT all components. RERUN Quick Test.
		No ▶	GO to **X81**.
X81	CHECK FAN RUNNING MODE		
	• Key Off. • Disconnect processor. • Integrated controller connected. • Key On. For 2.5L MTX > Does fan run? For 2.5L and 3.0L ATX > Does fan run at low speed? For 2.3L EFI TC > Does primary fan run?	Yes ▶	REPLACE processor. RECONNECT all components. RERUN Quick Test.
		No ▶	REPLACE Integrated Controller. RECONNECT all components. RERUN Quick Test.
X82	FAN ALWAYS ON WITH CODE 82 OR 88: CHECK EDF PROCESSOR SIGNAL TO INTEGRATED CONTROLLER FOR OPEN CIRCUIT		
	• Key Off. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, and loose wires. Service as necessary. • Breakout box installed. • Processor and integrated controller disconnected. • DVOM on 200 ohm scale. • Measure resistance between test Pin 55 and integrated controller harness Pin 14. • Is resistance 5 ohms or less?	Yes ▶	GO to **X83**.
		No ▶	SERVICE open in EDF circuit. RECONNECT all components. RERUN Quick Test.

Integrated Controller | Pinpoint Test | X

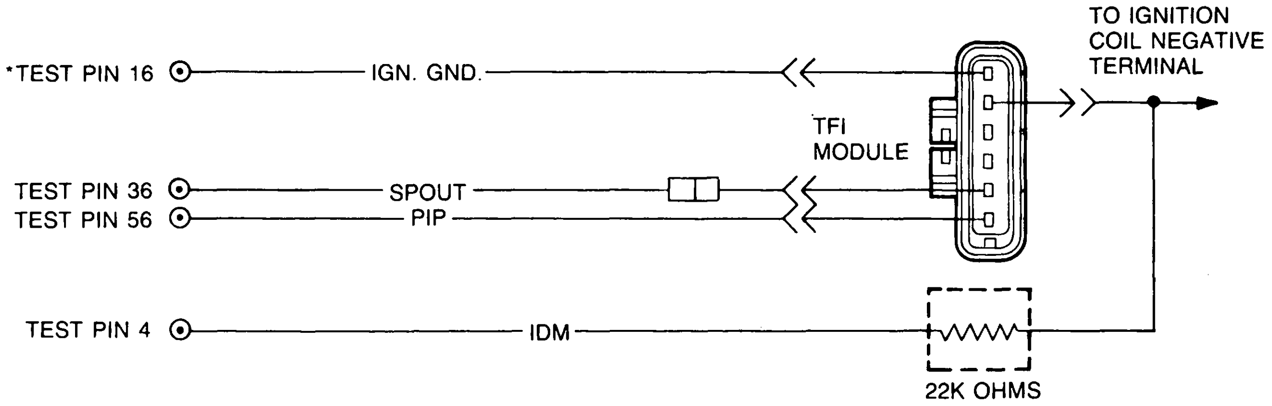
TEST STEP		RESULT ▶	ACTION TO TAKE
X83	CHECK EDF CIRCUIT FOR SHORTS TO POWER		
	• Key Off. • Breakout box installed. • Processor and integrated controller disconnected. • DVOM on 200,000 ohm scale. • Measure resistance from test Pin 55 to test Pin 37, and from test Pin 55 to battery positive. • Is resistance 10,000 ohms or less?	Yes ▶	SERVICE short to power in EDF circuit. GO to **X84**.
		No ▶	GO to **X84**.
X84	EDF SHORT TO GROUND CHECK		
	• Key Off. • Breakout box installed. • Processor disconnected. • Integrated controller connected. • Key On. • Jumper test Pin 55 to ground test Pin 40 or 60. • Does fan continue to run?	Yes ▶	REPLACE Integrated Controller. RECONNECT all components. RERUN Quick Test.
		No ▶	REPLACE processor. RECONNECT all components. RERUN Quick Test.

Erratic Ignition

Pinpoint Test

Y

Y



*TEST PINS LOCATED ON BREAKOUT BOX.
ALL HARNESS CONNECTORS VIEWED INTO MATING SURFACE.

A9913-A

STOP-WARNING

You should enter this Pinpoint Test only when a service code 14 is received in Quick Test Step 6.0.

To prevent the replacement of good components, be aware that the following non-EEC areas may be at fault:

- TFI module.
- Arcing secondary ignition components.
  - — Ignition coil.
  - — Spark plugs and high tension cables.
- Distributor and PIP sensor.

This Pinpoint Test is intended to diagnose only the following:

- Harness circuits: ignition ground, spout, PIP, IDM.

Erratic Ignition

Pinpoint Test

Y

TEST STEP	RESULT ▶	ACTION TO TAKE
Y1 CODE 14: ERRATIC IGNITION **NOTE: Code 14 indicates two successive erratic profile ignition pickup (PIP) pulses occurred, resulting in a possible engine miss or stall.** ○ Check EEC-IV and ignition systems harnesses for: — Loose wires/connectors. — Arcing secondary ignition components (coil, cap, rotor, wires, plugs, etc.). — On-board transmitter (2-way radio).* ○ Are any of the above present? *Verify all 2-way radio installations. Carefully follow manufacturer's installation instructions regarding the routing of antenna and power leads.	Yes ▶	SERVICE as necessary. RERUN Quick Test.
	No ▶	GO to Y2.
Y2 CHECK DISTRIBUTOR ○ Key Off, wait 10 seconds. ○ Deactivate Self-Test. ○ Connect VOM or STAR per Quick Test Step 2.0. ○ Enter Engine Running Continuous Monitor Test (as instructed in Quick Test Step 6.3). ○ Observe VOM or STAR LED for indication of a fault while performing the following: ○ Lightly tap on TFI module and distributor. ○ Wiggle TFI connector. ○ Is a fault indicated?	Yes ▶	DISCONNECT and INSPECT connectors. If connector and terminals are good, GO to Section 15, Ignition System Diagnostics.
	No ▶	GO to Y3.
Y3 CHECK EEC-IV HARNESS ○ While still in Continuous Monitor Test from Step Y2 observe VOM or STAR LED for a fault indication while performing the following: ○ While looking for faults grasp the harness close to the TFI connector. Wiggle, shake or bend a small section of the ignition and EEC-IV systems harness while working your way to the other components and dash panel. Also wiggle, shake or bend the EEC-IV harness from the dash panel to the processor. Isolate the PIP circuit if needed for this test. ○ Is a fault indicated?	Yes ▶	ISOLATE fault and SERVICE as necessary. RERUN Quick Test.
	No ▶	GO to Y4.

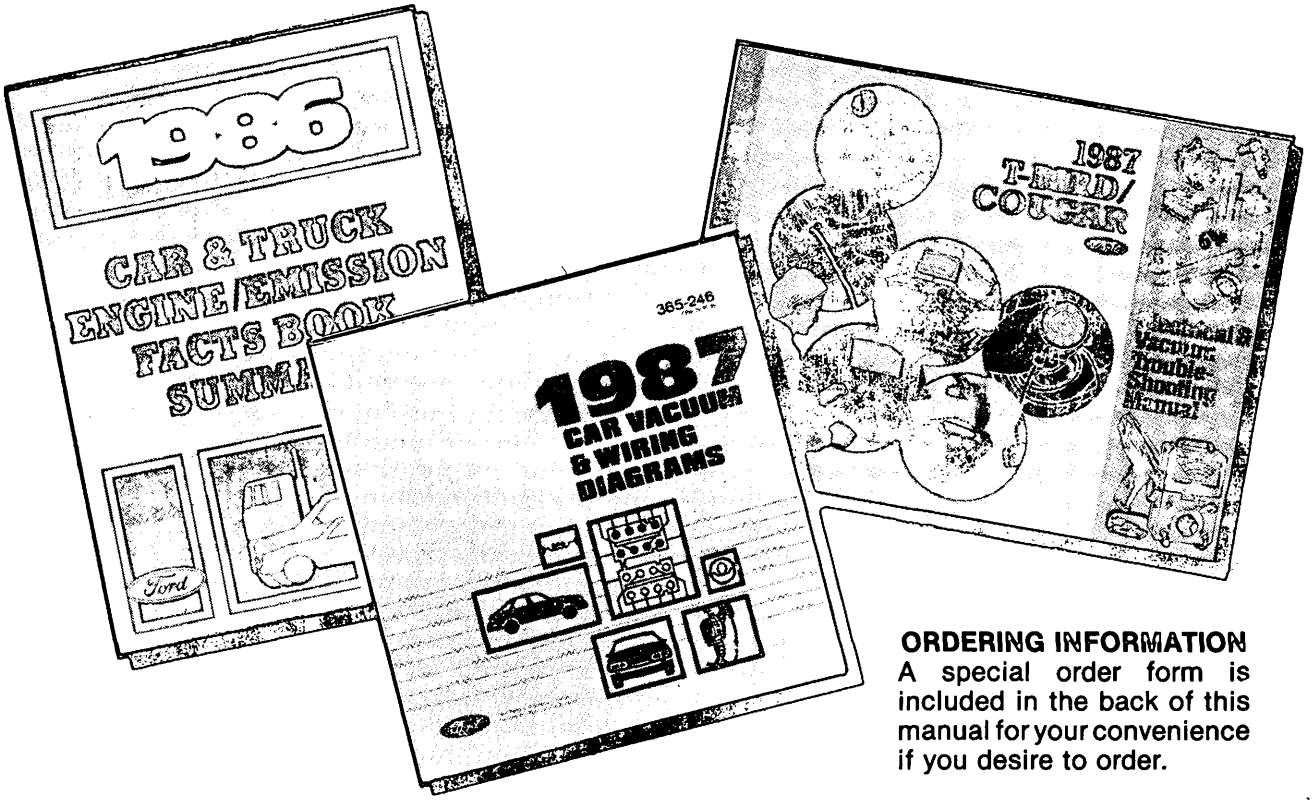
Erratic Ignition

Pinpoint Test Y

TEST STEP		RESULT ▶	ACTION TO TAKE
Y4	CHECK PROCESSOR AND HARNESS CONNECTORS		
	• Key Off, wait 10 seconds. • Disconnect processor 60 Pin connector and inspect for damaged pins, corrosion, loose wires. • Are connectors and terminals OK? • Reconnect processor when this Step is completed.	Yes ▶	Unable to duplicate an erratic ignition fault in the EEC-IV System, for further diagnosis, GO to Section 15, Ignition System Diagnostics.
		No ▶	SERVICE as necessary. RERUN Quick Test.

OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS



ORDERING INFORMATION
A special order form is included in the back of this manual for your convenience if you desire to order.

ENGINE EMISSIONS FACTS BOOK

- The manual contains complete specifications for each calibration number.
- Published at the conclusion of the model year.

ELECTRICAL & VACUUM TROUBLESHOOTING MANUAL (EVTM)

- Available for all passenger car and light truck vehicles, this publication provides schematics of all electrical and vacuum circuits. Wiring diagrams show how the circuit is powered. Troubleshooting hints are provided to point the technician in a general direction but are not step by step procedures.
- Available in the first quarter of the model year. (One manual for each passenger car and light truck family.)

WIRING & VACUUM DIAGRAMS

- This publication contains wiring diagrams for all Ford and Lincoln/Mercury passenger car and light truck vehicles. A Power Distribution system illustrates the power distribution throughout each vehicle. In addition, all individual electrical circuits are shown for each vehicle line.
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Service Specifications Manuals

(CAR AND TRUCK)

- These manuals contain all specifications including maintenance and lubrication contained in the Shop Manuals in a handy pocket size for easy reference.
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SECTION 20

Driveability Intermittents

Contents

FAULT PAGE

Intermitent No Start And Quits On Road With No Restart .20-3

Intermittent Surging At Steady Speed .20-12

Intermittent Quits On Road And Restarts .20-22

Intermittent Bucking And Jerking .20-26

Intermittent Erratic Running/Rough Idle .20-36

Intermittent Fault Diagnosis

WHEN TO USE INTERMITTENT FAULT DIAGNOSIS

It is recommended, that before using this Section for the first time, you view the video program that explains the steps used in this Section. The video program is available in laser disc for viewing in the dealership and a VHS format for home video recorders.

INTERMITTENT FAULT DIAGNOSIS DESCRIPTION

Intermittent fault diagnosis provides a technique that you can use to find an intermittent fault. **A vehicle is diagnosed with an intermittent fault when:**

- **The vehicle has been returned to the dealership with a fault that cannot be duplicated by the technician under normal driving conditions.**

Prior to starting these procedures, the technician **must** have checked out all mechanical systems according to Section 2 of the manual.

Before beginning, the Service Writer should contact the customer and complete the "Customer Contact Sheet." These questions may help you in duplicating the problem, which in turn will allow you to correct the concern.

NOTE: The following procedures for finding intermittent faults DO NOT provide exact answers to problems. They provide a technique that has been proven to correct intermittent faults. At times, it may be necessary to use your own judgement when diagnosing an intermittent fault.

Intermittent Fault Diagnosis — Customer Contact Sheet Instructions

NOTE TO THE SERVICE WRITER:

Circle the answers obtained when asking the following questions of the DRIVER of the vehicle. If at all possible, talk to the person or persons who where driving the vehicle when the problem occurred. This may not be the person who brought the vehicle in for service.

NOTE: The terms cold, warm and hot are used in the following questions. An engine is considered cold up until two minutes after starting the engine. A warm condition is from two to four minutes after starting the vehicle. A hot condition is present after the upper radiator hose is hot and pressurized. If the start-up occurs under adverse temperature conditions such as below zero or above 100 degrees Fahrenheit you will have to take this into consideration.

Ask the driver the following questions:

1. What exactly is the problem?
2. What happens to the vehicle when the problem occurs?
3. When was the last time the vehicle showed this driveability problem?
   - o Was this while the vehicle was moving, and most often:

     During braking?

     During a change from acceleration to a coast condition?

     When turning? If yes, at what speed?

     When driving over rough roads?

     When accelerating?

     When driving at any speed?

     In a certain gear range?

     When the heater or air conditioner was turned on?

     When turning the steering wheel to a full stop?

     When the clutch was depressed? When the clutch was let up?

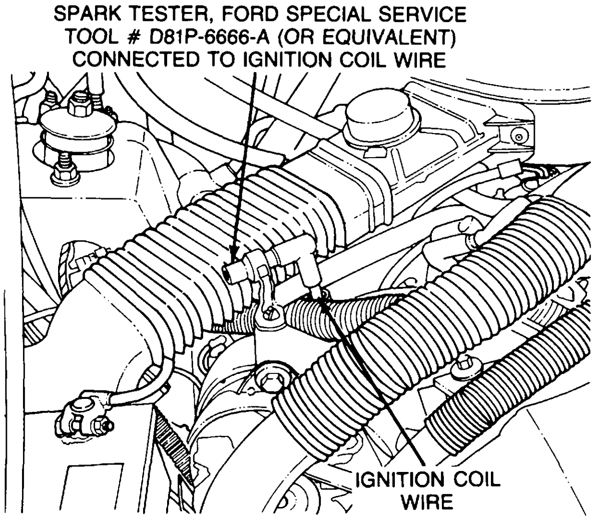
     Was this during any of the following drive conditions:

     — cold engine **start-up, idle, driveaway, cruise, acceleration, deceleration**?

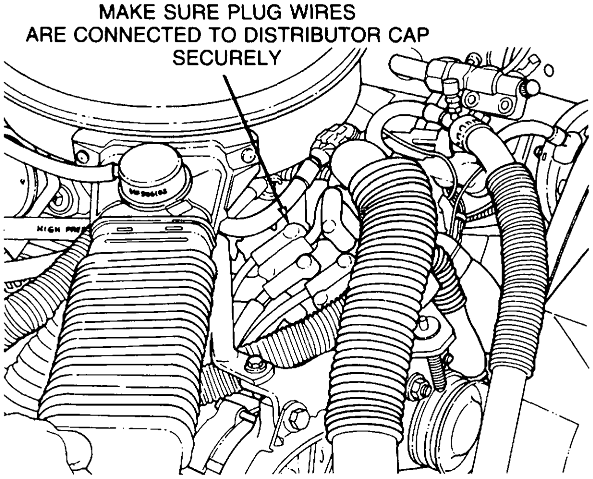
     — warm engine **start-up, idle, driveaway, cruise, acceleration, deceleration**?

     — hot engine **start-up, idle, driveaway, cruise, acceleration, deceleration**?
4. Does the problem vary with vehicle speed?
5. Does the problem vary with engine speed?
6. Does the problem happen only when starting the vehicle?
7. Do you remember what the driving conditions were when the problem occurred the time before the last time?
   - o If yes, were the conditions the same as stated above for the latest problem?
8. When the problem occurs, does the vehicle or engine make a noise?
   - o If yes, please describe the noise.
9. Has the vehicle been worked on, for this problem, by anyone else?
   - o If yes, who?
10. Do you purchase your fuel at the same station at all times?
11. If not, does the problem occur when you purchase your fuel at a certain station?
12. Do you purchase the same grade of fuel (octane level) at all times?
13. Does the problem occur when you purchase a different grade (octane level) of gasoline?
14. Is there anything else that might help us in locating the problem?

Intermittent No Start And Quits On Road With No Restart

STEPS	POSSIBLE ACTION TO TAKE
- Review the repair order. **If required, contact the driver or drivers of the vehicle to get further information. Refer to the Customer Contact Sheet on page 2 of this Section.**	- If repair order shows any pattern (e.g., no-start occurs whenever the engine is warm or cold), duplicate the same condition and try to start the vehicle.
- Visually inspect the engine compartment. **DO NOT disturb anything.**	- If you determine by a visual inspection that anything is disconnected, **do not reconnect the item. If you move any component or connection, you could make it harder to repeat the intermittent problem. NOTE: Look for areas where electrical wires or vacuum lines could be cut by sharp edges or burned by engine hot spots. Blocked or kinked vacuum lines can also cause trouble.**
- Try to start the vehicle.	- If vehicle does not start, perform routines according to Volume H.
- If vehicle starts, take it for a test drive for "Quits on Road with no Restart" condition. **Take along the spark tester.**	- If vehicle quits on road and can't be restarted, listen for the sound of the fuel pump operating when the ignition key is turned On and check for spark at the coil. Then check TSBs for this concern when you get back to the shop if applicable.  SPARK TESTER, FORD SPECIAL SERVICE TOOL # D81P-6666-A (OR EQUIVALENT) CONNECTED TO IGNITION COIL WIRE IGNITION COIL WIRE

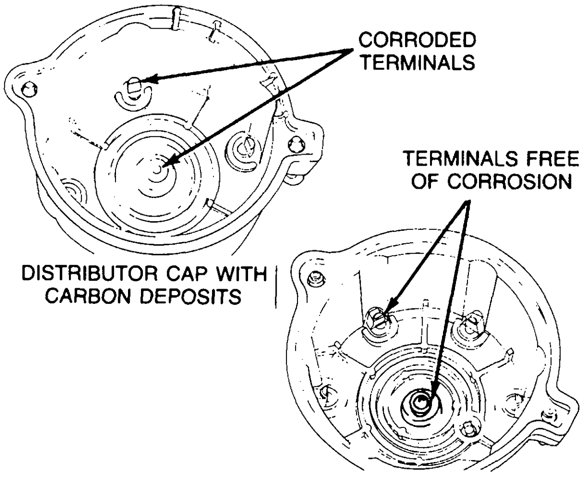
Intermittent No Start And Quits On Road With No Restart

STEPS	POSSIBLE ACTION TO TAKE
o If you cannot verify the concern, contact the driver of the vehicle for additional information.	o If the driver leads you to another vehicle system, work on that system. If not, continue to the next step.
o Check the ignition system secondary wires for damage or loose connections.	o If ignition system secondary wires are **not** damaged or loose, continue to the next step. o If secondary wires are damaged, replace them and try to start the vehicle. o If secondary wires are loose, repair as necessary and try to start the vehicle.  MAKE SURE PLUG WIRES ARE CONNECTED TO DISTRIBUTOR CAP SECURELY

Intermittent No Start And Quits On Road With No Restart

<table>
<tr><th>STEPS</th><th>POSSIBLE ACTION TO TAKE</th></tr>
<tr><td>

- Check distributor cap for moisture, cracks, or salt-like deposits.



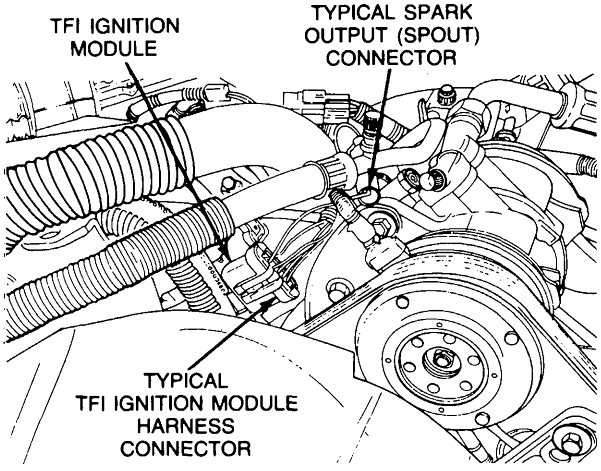
GOOD DISTRIBUTOR CAP

</td><td>

- If distributor cap has moisture, find out why. If necessary, replace the cap.
- If distributor cap has cracks or salt-like deposits, replace the cap with a new one.
- Check the rotor for damage or burns.
- If rotor is damaged or burned, replace with a new one, and try to start the vehicle.

</td></tr>
<tr><td>

- Check the TFI ignition module for damage or loose connections. **NOTE: Do not use the TFI ignition module as a fulcrum for turning the distributor.**



</td><td>

- Replace the TFI ignition module if damaged.

</td></tr>
<tr><td>

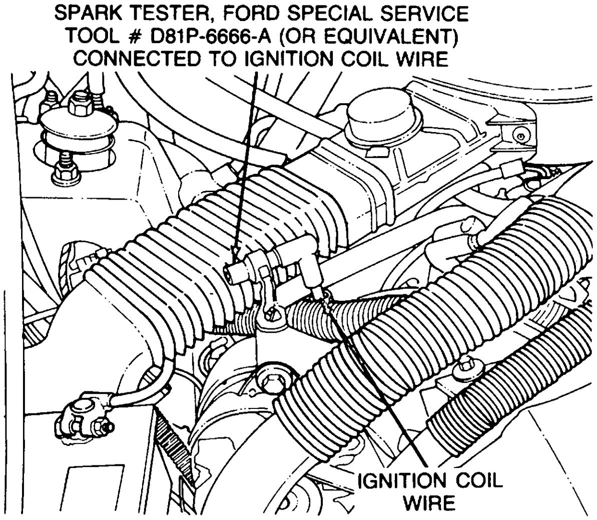
- Check the TFI ignition module six-pin connector to ensure it is installed correctly and that the gasket is not folded over.

</td><td>

- Repair any loose connections. Reinstall connector if not properly installed.

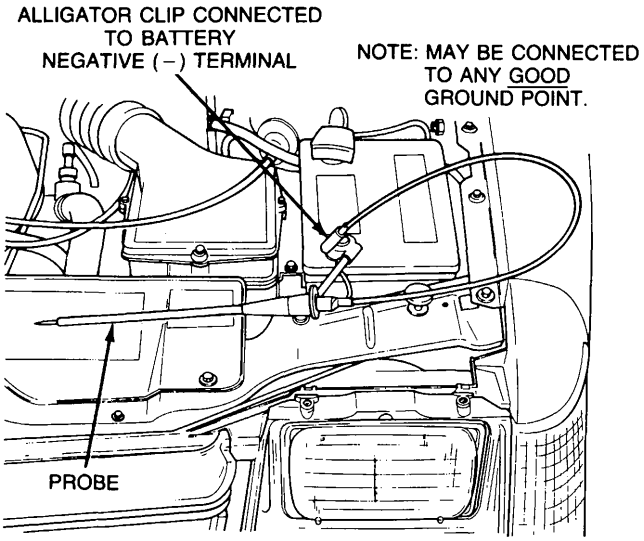
</td></tr>
</table>

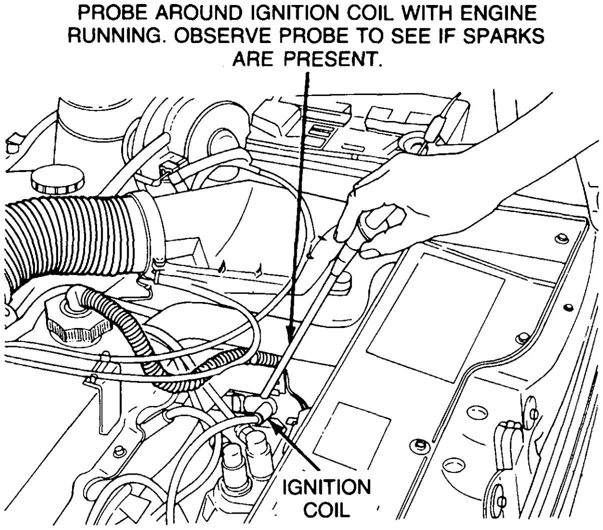
Intermittent No Start And Quits On Road With No Restart

STEPS	POSSIBLE ACTION TO TAKE
o Install a spark tester to the ignition system coil wire. **NOTE: Disconnect the wire at the distributor.** Crank the engine. o Verify that a good, strong blue spark is observed while the engine is cranking. This indicates that the coil and primary circuit are OK. o **NOTE: By connecting the spark tester to the coil wire, you are able to verify that the coil is firing on each PIP signal.** **NOTE: Never allow the spark from the coil wire to go directly to ground. This could cause internal damage to the coil.**  SPARK TESTER, FORD SPECIAL SERVICE TOOL # D81P-6666-A (OR EQUIVALENT) CONNECTED TO IGNITION COIL WIRE IGNITION COIL WIRE	o If a good, strong blue spark is not detected, repair according to ignition procedures located in Section 15 of Volume H. o If an intermittent spark is present, the ignition coil may be damaged internally.
o With the spark tester still connected to the coil wire, wiggle the ignition primary connectors while cranking the engine. o **NOTE: By performing this test while cranking, we check those circuits dedicated to the start mode.**	o If an intermittent loss of spark is detected, there could be an intermittent open in the TFI ignition module connector or harness that could cause an intermittent no-start. o **NOTE: An intermittent open in the TFI ignition module or harness could cause a no-start by preventing the TFI ignition module from firing the coil.** o **NOTE: An intermittent open in the coil primary harness or connecter could cause a no-start because the coil is not receiving battery voltage.**

Intermittent No Start And Quits On Road With No Restart

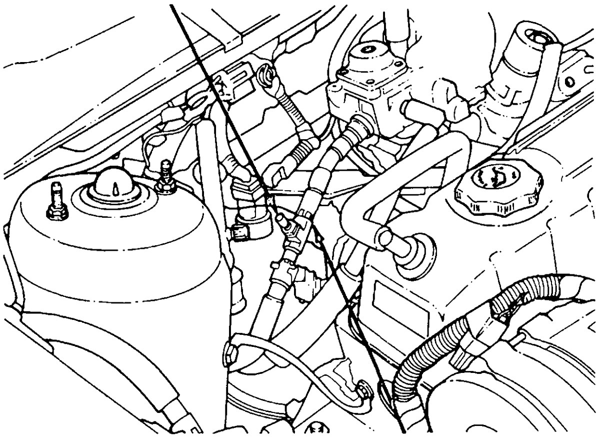
STEPS	POSSIBLE ACTION TO TAKE
• **NOTE: For the following test the engine MUST be running.** Use a jumper wire with an alligator clip at both ends. Attach one of the clips to a **good** ground location. Attach the other end to the metal part of a screwdriver. While the engine is running, pass the screwdriver around the base of the coil. **WARNING: USE CAUTION NOT TO GET THE SCREWDRIVER OR WIRE ENTANGLED WITH THE DRIVE BELTS OF THE VEHICLE.**	• Arcing indicates a breakdown in the insulation of the coil or coil wire.


ALLIGATOR CLIP CONNECTED TO BATTERY NEGATIVE (−) TERMINAL
NOTE: MAY BE CONNECTED TO ANY GOOD GROUND POINT.
PROBE

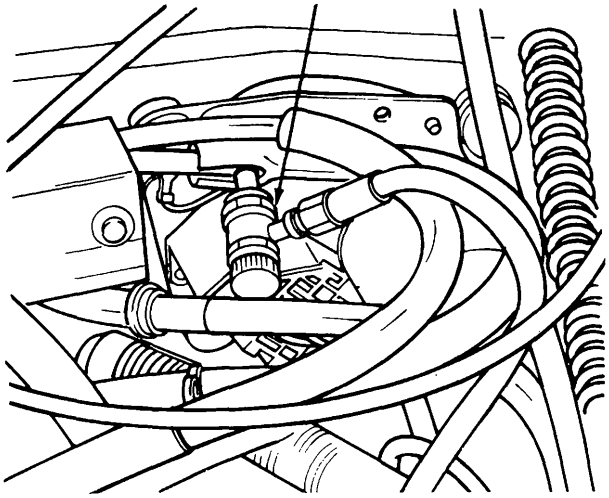
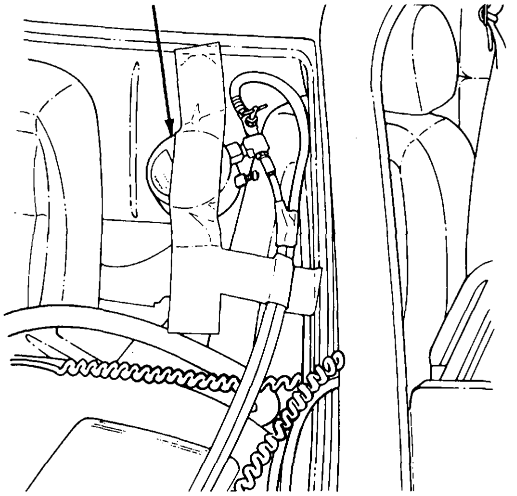

PROBE AROUND IGNITION COIL WITH ENGINE RUNNING. OBSERVE PROBE TO SEE IF SPARKS ARE PRESENT.
IGNITION COIL

STEPS	POSSIBLE ACTION TO TAKE
• If the vehicle is running, turn it Off. From inside the vehicle, using the ignition switch, "**bump/ crank**" the engine approximately ten times.	• If the engine fails to start on any of the tries, the ignition switch may be damaged internally.
• Connect a fuel pressure gauge to the engine with an extension hose long enough to allow the gauge to reach the windshield, as outlined in Group 24 of the Shop Manual. **NOTE: A suitable hose was issued in the 1985 Ford Tool Package.** **NOTE: For 2.3L and 2.5L HSC engines, and other applications without a Schrader valve installed in the fuel system, use Rotunda Tool D85L-9974-B, In-Line Pressure Tester Adapter.**	• If the pressure **does not** increase each time the key is turned to On, there is a problem in the fuel system. • Check the inertia switch, the fuel pump relay wiring connectors, and the fuel pump ground connection for looseness, corrosion, or other factors that could cause an intermittent open circuit. **NOTE: On certain vehicles the fuel pump ground is located beside the driver's seat, under the carpet. Refer to past TSBs for fuel pump ground locations.**

Intermittent No Start And Quits On Road With No Restart

STEPS	POSSIBLE ACTION TO TAKE
FUEL PRESSURE VALVE TO ROTUNDA FUEL PRESSURE TESTING GAUGE 014-00447  ADAPTER D85L-9974-B CONNECTED IN LINE BETWEEN LOW-PRESSURE FUEL INJECTION CHARGING ASSEMBLY AND FUEL LINE • Tape the pressure gauge to the windshield. This allows you to read the fuel pressure from the inside of the vehicle. **NOTE: Do not tape the pressure gauge where it will interfere with the windshield wiper blades or linkage.** • Turn the ignition key to the ON position for two seconds, watch the fuel gauge for a pressure increase. Repeat the procedure ten times. There should be a pressure increase each time the key is turned On. **NOTE: On engines equipped with a 10 second delay power relay, pause 10 seconds between turning the key Off and On.**	

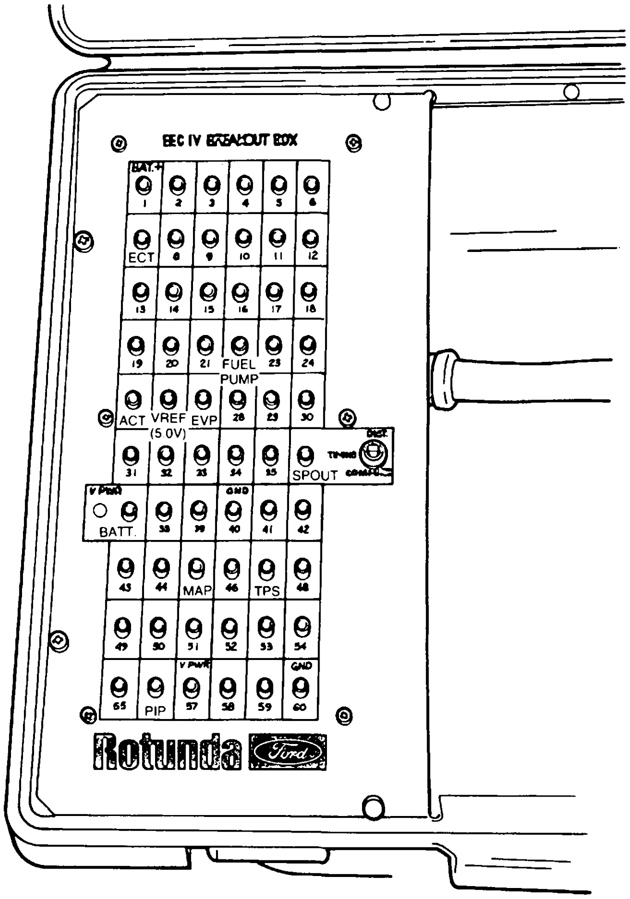
Intermittent No Start And Quits On Road With No Restart

STEPS	POSSIBLE ACTION TO TAKE
ROTUNDA FUEL PRESSURE TESTING GAUGE 014-00447 — TYPICAL HOOK-UP TO FUEL PRESSURE VALVE 	ROTUNDA FUEL PRESSURE TESTING GAUGE 014-00447 — TYPICAL HOOK-UP SHOWING GAUGE TAPED TO OUTSIDE OF WINDSHIELD 
• If the fuel and ignition systems are OK, check the spark plugs for soot or fuel fouling.	• If spark plugs are fouled, clean or replace as required.
• **If the intermittent fault is still present, refer to Section 2.**	• **If after referring to Section 2 and running the Quick Test according to procedures found in this book, the fault is not found, continue to the next step.**

NOTE: Do not continue to the next step unless the Quick Test has been performed according to procedures outlined in this book, and the intermittent fault has NOT been found.

• If the Quick Test did not find the cause of the intermittent fault, prepare the vehicle for another road test. • Verify that the fuel pressure gauge is still attached securely to the windshield. Hook up the Black STAR tester and connect the breakout box. • Label the following key points on the breakout box: — battery voltage — reference voltage — throttle position sensor — PIP signal — ECT sensor — ACT sensor — SPOUT signal — fuel pump (circuit at ECA)	• Make a copy of the five-column chart located at the end of this section and record the readings taken with the ignition key in the ON position and also while the engine was cranking, and stabilized at idle. • These are "baseline" readings of key voltages while the engine is operating properly. By comparing these baseline readings with the readings when the intermittent symptom occurs, it is possible to isolate the component or circuit that is at fault.

Intermittent No Start And Quits On Road With No Restart

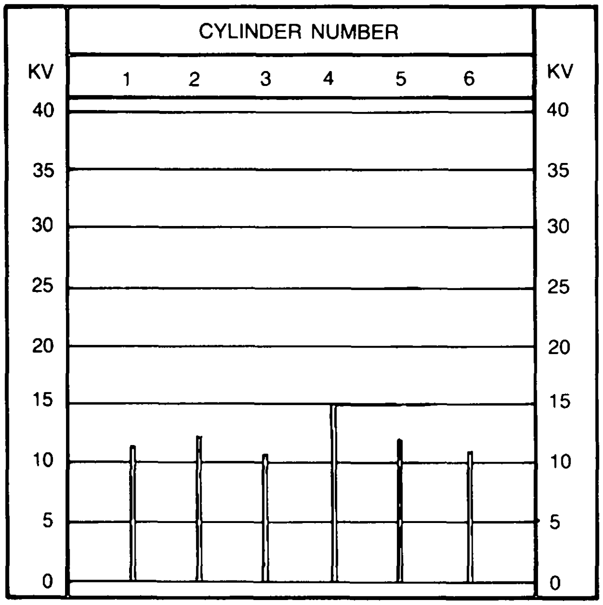
STEPS	POSSIBLE ACTION TO TAKE
ROTUNDA EEC-IV 60-PIN BREAKOUT BOX 014-00322 — WITH KEY PINS LABELED  EEC IV BREAKOUT BOX BAT.+ ECT FUEL PUMP ACT VREF (5.0V) EVP SPOUT DIST. TIMING COMPUTER V PWR BATT. GND MAP TPS V PWR GND PIP Rotunda Ford ○ **NOTE: Refer to the correct vehicle "Engine Supplement" Section for the correct pin numbers for the points listed.** ○ Disconnect the coil primary connector so the engine will not start. Turn the ignition key to the ON position and check key points with a DVOM. **DO NOT CRANK THE ENGINE AT THIS TIME.** ○ Repeat the procedure while cranking the engine. ○ Repeat the procedure at stabilized idle.	
○ After recording the baseline readings, keep the ignition key in the ON position and perform a Key On/Engine Off Quick Test.	○ When the Key On/Engine Off Quick Test is completed and everything has checked out properly, unlatch the STAR tester.

Intermittent No Start And Quits On Road With No Restart

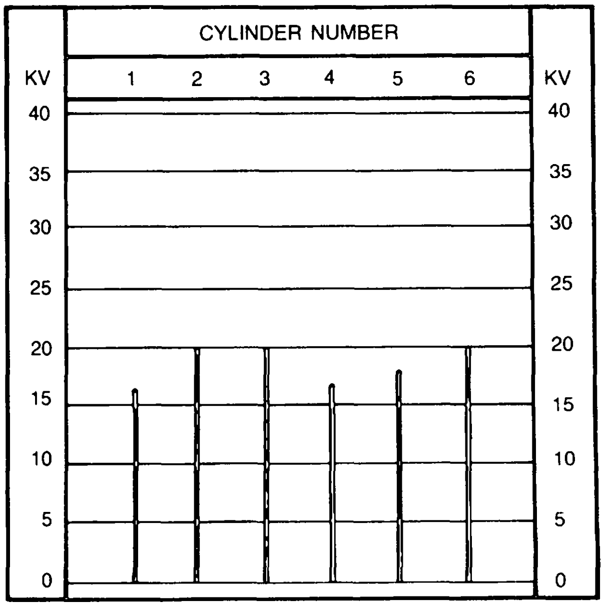
STEPS	POSSIBLE ACTION TO TAKE
• Start the vehicle, and enter the "wiggle test" mode.	• If the STAR tester detects a fault in wiggle test mode during the test drive, it will beep, and the code can be retrieved from memory.
• On the following test drive, take along the spark tester, DVOM and Volume H. • Begin vehicle test drive. At first half of the test drive, note the fuel pressure gauge reading. • **NOTE: Before starting the test drive, make sure the line to the fuel pressure gauge and the test equipment wires are properly connected and routed to avoid pinching or crimping.**	• If there is a decrease in the fuel pressure, there may be a blockage in the fuel filter, a kinked fuel line, or insufficient voltage to the fuel pump. • Information received from the driver may now help you to narrow down the problem. • If the engine quits during the test drive, carefully coast to the side of the road, **but do not move the ignition key from the ON position.**
• Now recheck the key points using the breakout box and DVOM.	• If the readings are different, check the circuit to locate the problem, and repair or replace as required. • If the readings are close to the baseline readings, continue to the next step.
• Latch the STAR tester and perform the Key On/ Engine Off and Engine Running Quick Tests.	• If the Quick Test steps detect a problem in the circuit, repair or replace as required. • If the Quick Test steps do not detect a problem in the circuits, continue to the next step.
• Check for spark. If no spark is detected, disconnect the SPOUT signal connector, and again check for spark.	• If spark is restored, go to the *no-start* Pinpoint Test in Volume H. • If spark does not appear, continue to the next step.
• Check for a PIP signal while cranking the engine.	• When the PIP signal is detected, check the TFI and E-core coil circuits for continuity using the DVOM. • If there is no PIP signal, **do not** assume that there is something wrong with the PIP sensor. Check the crank, run, and ground circuits at the TFI connector first.

Intermittent Surging At A Steady Speed

STEPS	POSSIBLE ACTION TO TAKE
o Review the repair order. **If required, contact the driver or drivers of the vehicle to get further information. Refer to the Customer Contact Sheet on page 2 of this Section.**	o If repair order shows any pattern (e.g., surge at steady speed occurs whenever the engine is warm or cold), try to duplicate the same condition.
o Visually inspect the engine compartment. **DO NOT disturb anything.**	o If you determine by a visual inspection that anything is disconnected, **do not reconnect the item. If you move any component or connection, you could make it harder to repeat the intermittent problem. NOTE: Look for areas where electrical wires or vacuum lines could be cut by sharp edges or burned by engine hot spots. Blocked or kinked vacuum lines can also cause trouble.**
o Take the vehicle for a test drive to try to verify the concern.	o If the concern is repeatable, check for any TSBs that might apply to this concern.
o If the concern is not repeatable, get more information; what speed is the intermittent surge at? Are there any certain conditions when the surge always happens?	o If the driver gives you information that might help in diagnosing the problem, take the vehicle on another test drive to try to duplicate the problem. o If the driver does not give you any more information, continue to the next step.
o Connect an engine analyzer to the vehicle. o Check plug firing voltages, cylinder balance, and base timing.	o If the engine analyzer shows a problem, repair or replace as required.

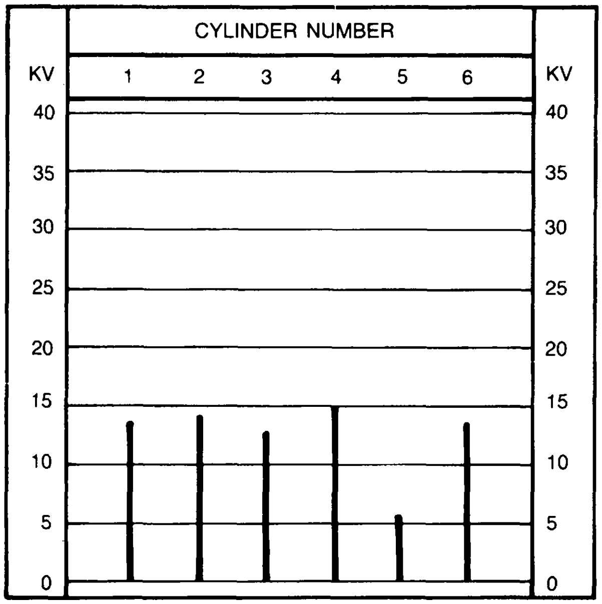


ENGINE ANALYZER DISPLAYS — PROPERLY OPERATING IGNITION SYSTEM

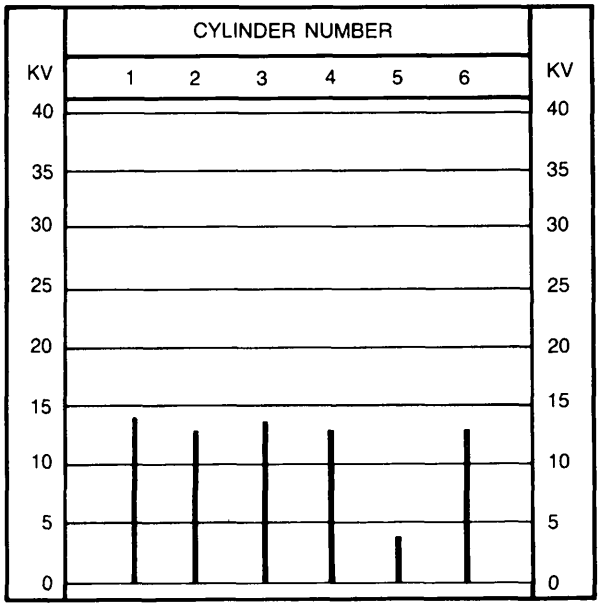


ENGINE ANALYZER DISPLAYS — AVERAGE PLUG FIRING VOLTAGE GREATER THAN 15KV

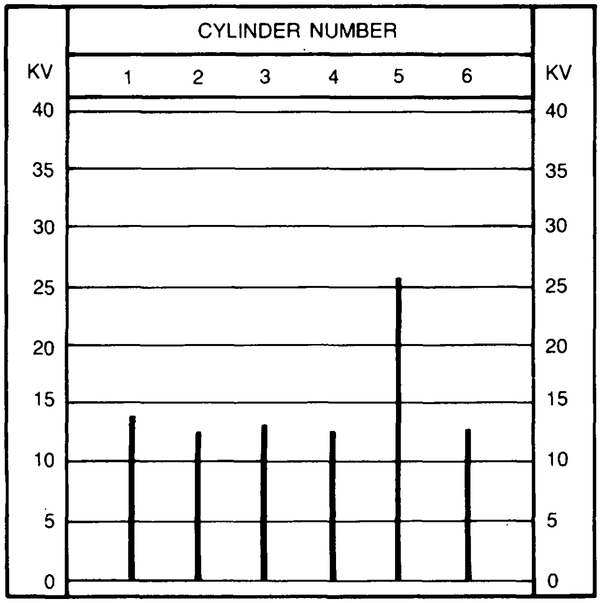
Intermittent Surging At A Steady Speed



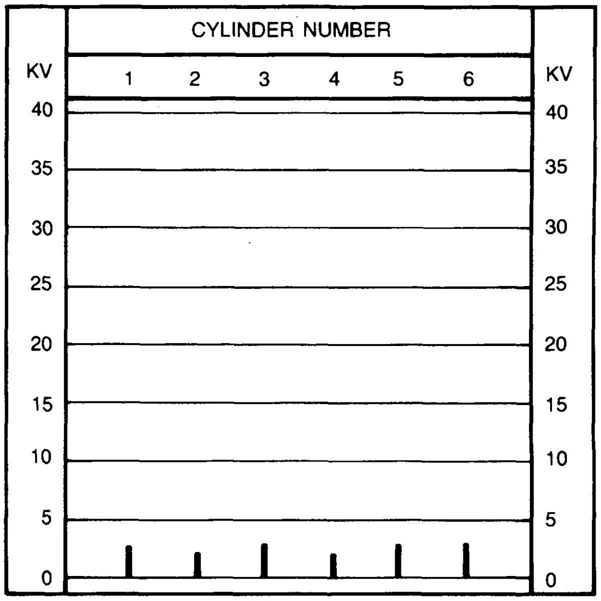
ENGINE ANALYZER DISPLAYS — PLUG FIRING VOLTAGE VARIATION GREATER THAN 5 KV



ENGINE ANALYZER DISPLAYS — LOW PLUG FIRING VOLTAGE IN ONE CYLINDER



ENGINE ANALYZER DISPLAYS — HIGH PLUG FIRING VOLTAGE IN ONE CYLINDER



ENGINE ANALYZER DISPLAYS — NEGATIVE FIRING VOLTAGE

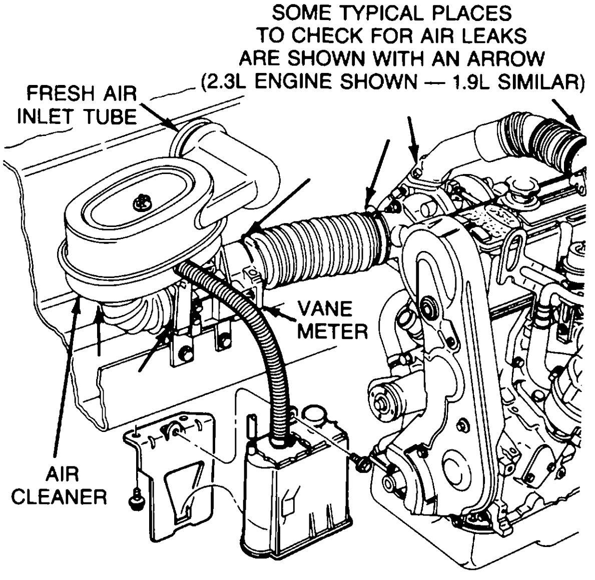
Intermittent Surging At A Steady Speed

STEPS	POSSIBLE ACTION TO TAKE
o When all tests have been performed on the engine analyzer, check the spark plugs for ash fouling, proper gap, and to make sure they are the right type of plug for the engine.	o If the spark plugs are fouled, clean or replace as required. If the spark plugs have an improper gap, regap and install. If the spark plugs are not the correct type, replace with the correct type of plugs. o If the spark plugs check out OK, continue to the next step.
o If the intermittent fault is still present, refer to Section 2.	**o If after referring to Section 2 and running the Quick Test according to procedures found in this book, the fault is not found, continue to the next step.**

NOTE: Do not continue to the next step unless the Quick Test has been performed according to procedures outlined in this book, and the intermittent fault has NOT been found.

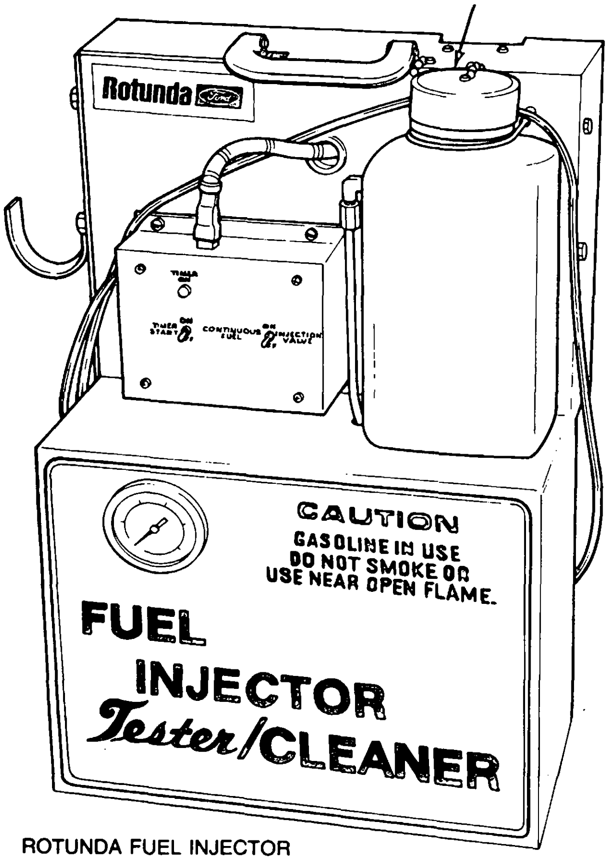
o Connect a MAP/BP tester to either the manifold absolute pressure (MAP) or barometric pressure (BP) sensor (depending on how vehicle is equipped) and check the readings with the engine Off and the ignition key in the ON position. o Compare the reading to the correct value listed on page 50 of this supplement. o If the vehicle is equipped with a MAP sensor, repeat the MAP test with the engine running. The MAP tester reading should decrease at idle and increase when you bump the throttle. **NOTE: If the vehicle is equipped with a barometric pressure (BP) sensor, the engine running portion of the test does not have to be performed since there is no vacuum hookup to the engine.**	o On a vehicle equipped with a MAP sensor, if the reading obtained with the engine OFF and ignition key ON does not match the value given in the Pinpoint Test, perform the appropriate Pinpoint Test in Volume H. o If the MAP sensor does not change when you bump the throttle with the engine running, substitute a known good hose for the original MAP sensor vacuum hose connected to the sensor and repeat the test. A change in the MAP tester reading indicates that the original hose was damaged, blocked or kinked. o On a vehicle equipped with either a MAP or BP sensor, substitute with a known good component and retest. If readings are now OK, replace the component.

Intermittent Surging At A Steady Speed

STEPS	POSSIBLE ACTION TO TAKE
• If the vehicle is equipped with a vane meter, **carefully** check for unmetered air leaks (i.e., loose air tubes, missing hoses or vacuum caps, etc.)  SOME TYPICAL PLACES TO CHECK FOR AIR LEAKS ARE SHOWN WITH AN ARROW (2.3L ENGINE SHOWN — 1.9L SIMILAR) FRESH AIR INLET TUBE VANE METER AIR CLEANER	• Correct air or vacuum leaks as necessary.
• With breakout box installed monitor vane meter signal while you manually move the vane meter door through its entire range.	• Voltage must increase smoothly as door is opened.
• Connect a Rotunda Fuel Injector Tester/Cleaner to the vehicle according to instructions that come with the unit. • Check the flow of the injectors against the specifications given with the Tester/Cleaner and the injector chart.	• If injector flow is not up to specifications, clean the injectors. Follow the instructions that come with the Tester/Cleaner.

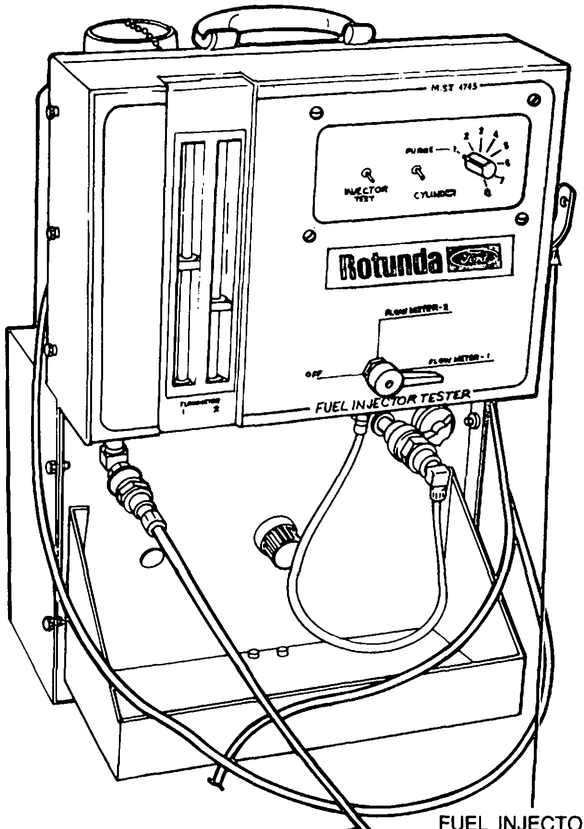
Intermittent Surging At A Steady Speed

STEPS	POSSIBLE ACTION TO TAKE



ROTUNDA FUEL INJECTOR
TESTER/CLEANER 113-00001

ROTUNDA FUEL INJECTOR TESTER/CLEANER
113-00001 — TYPICAL HOOK-UP TO FUEL INJECTORS
AND FUEL PRESSURE VALVE



Intermittent Surging At A Steady Speed

The following charts list fuel injector applications, part numbers, source, color code and injector specifications.

HIGH PRESSURE CFI INJECTOR APPLICATION

ENGINE APPLICATION	MODEL YEAR	PART NO. - 9F593 -	SOURCE	COLOR CODE	INJECTOR SPECS.	
					SIZE	RESIST
					gm/sec	Ohms
1.6L	1983	E3EE-BA	Bosch	Blue	1.76 (14#/HR)	2.25
	1984	E4EE-AA	N.D.	Blue		2.35
1.6L T/C	1984-85	E4EX-AA	Bosch	Black	3.00 (23#/HR)	2.40
1.9L	1985-1/2-86	E6EE-AB	Bosch	White	2.45 (19#/HR)	2.25
2.3L T/C	1983	E3ZE-BA	Bosch	Green	3.86 (30#/HR)	2.40
	1984	E4ZE-AA	D.K.K.			2.35
	1985	E5ZE-AA	D.K.K.	Brown	4.41 (35#/HR)	2.35
	1986	E5ZE-AB	D.K.K.			
2.3L (Truck)	1985	E59E-AA	N.D.	Gray	1.76 (14#/HR)	16.20
	1986	E59E-AB	N.D.			
2.9L (Car/Truck)	1986	E67C-A1B	Bosch	Gray	1.76 (14#/HR)	14.50
3.0L (Car/Truck)	1986	E59E-AB	N.D.	Gray	1.76 (14#/HR)	16.20
		E67E-BB	Bosch			14.50
3.8 CFI	1984-86	E3VE-A1A	Bosch	Green	4.54 (37#/HR)	2.25
		-A2A	N.D.			2.00
5.0L CFI	1980	EOSE-AA	Bosch	Blue	5.81 (46#/HR)	2.40
	1983	EOSE-A1A	Bosch			2.40
		EOSE-A2A	N.D.			2.00
	1984	EOSE-A1A	Bosch			2.25
		EOSE-A2A	N.D.			2.00
5.0L H.O. CFI	1984-85	E4ZE-CA	Bosch	Gray	6.60 (52#/HR)	2.25
5.0L SEFI	1986	E59E-AB	N.D.	Gray	1.76 (14#/HR)	16.20
		E67E-BB	Bosch			14.50
5.0L H.O. SEFI	1986	E6TE-AB	N.D.	Gold	2.45 (19#/HR)	16.20
5.0L Truck	1985	E5TE-AA	Bosch	Gold	2.45 (19#/HR)	15.50
		E5TE-AA	N.D.			16.20
		E5TE-AA	D.K.K.			16.20
	1986	E5TE-AB	D.K.K.			16.20
		E5TE-BB	Bosch			14.50

LOW PRESSURE CFI INJECTOR APPLICATIONS

2.3L HSC	1985-86	E43E-AC	Bosch	Blue	7.00 (56#/HR)	1.40
2.3L H.O. HSC (Manual Trans. Only)	1985	E53E-AB	Bosch	Green	8.00 (64#/HR)	1.40
2.5L HSC	1986	E53E-AB	Bosch	Green	8.00 (64#/HR)	1.40

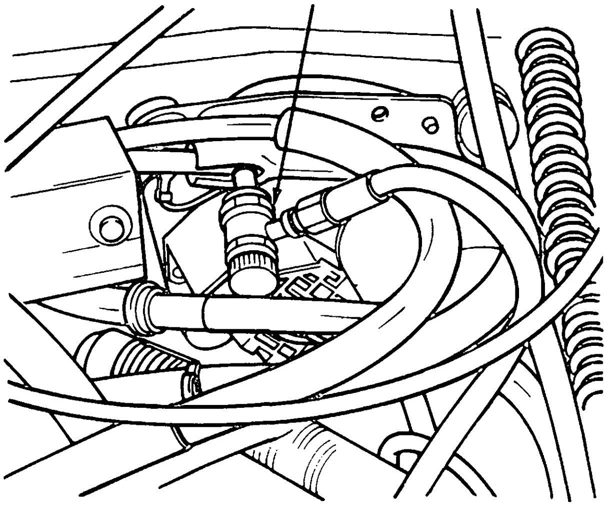
Intermittent Surging At A Steady Speed

STEPS	POSSIBLE ACTION TO TAKE
o After cleaning the injectors, test the injector flow again.	o If the injectors still do not meet specifications, replace them.
o If the problem still exists, and you have not done so yet, check the OASIS system and related TSBs.	o If TSBs or OASIS do not take you in a direction toward fixing the problem, continue to the next step.

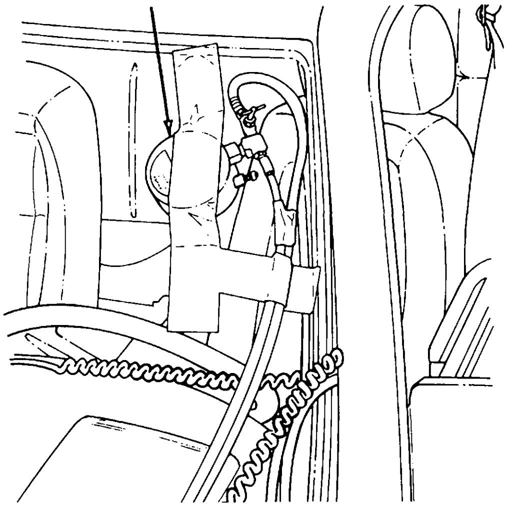
NOTE: For 2.3L and 2.5L HSC engines, and other applications without a Schrader Valve installed in the fuel systems, use Rotunda Tool D85L-9974B, In-Line Pressure Tester Adapter.

o Install a fuel pressure gauge with an extension hose, so that the fuel pressure can be monitored during the test drive. (Tape the fuel pressure gauge to the windshield for easy viewing.)	o Make a copy of the five-column chart at the end of this section and record the readings on the breakout box, vacuum gauge and fuel pressure gauge taken with the ignition key in the ON position while the engine was cranking. o These are "baseline" readings of key voltages, vacuum condition and fuel pressure while the engine is operating properly. By comparing these baseline readings with the readings when the intermittent symptom occurs, it is possible to isolate the component or circuit that is at fault.

ROTUNDA FUEL PRESSURE TESTING GAUGE 014-00447 — TYPICAL HOOK-UP TO FUEL PRESSURE VALVE

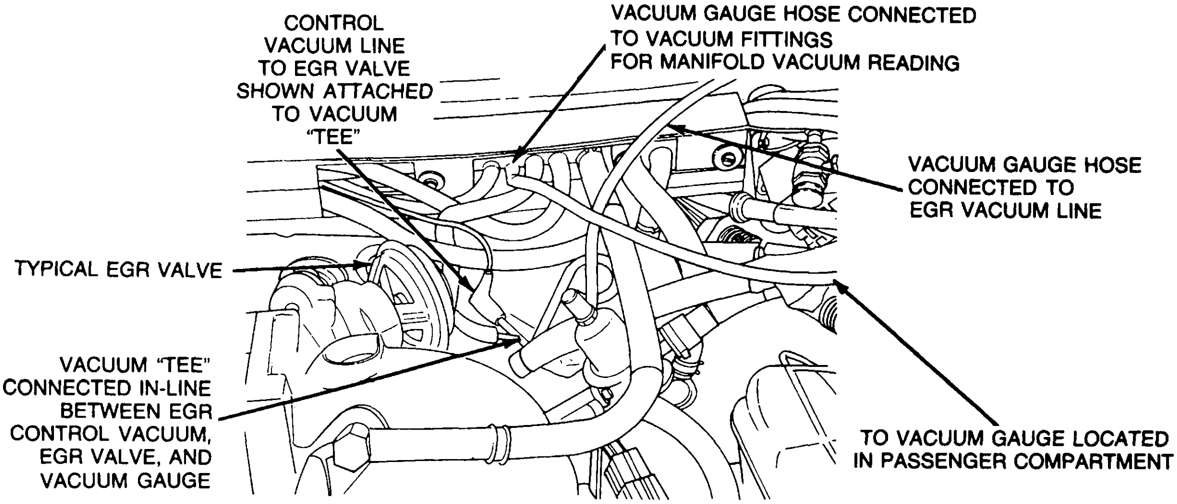


ROTUNDA FUEL PRESSURE TESTING GAUGE 014-00447 — TYPICAL HOOK-UP SHOWING GAUGE TAPED TO OUTSIDE OF WINDSHIELD



Intermittent Surging At A Steady Speed

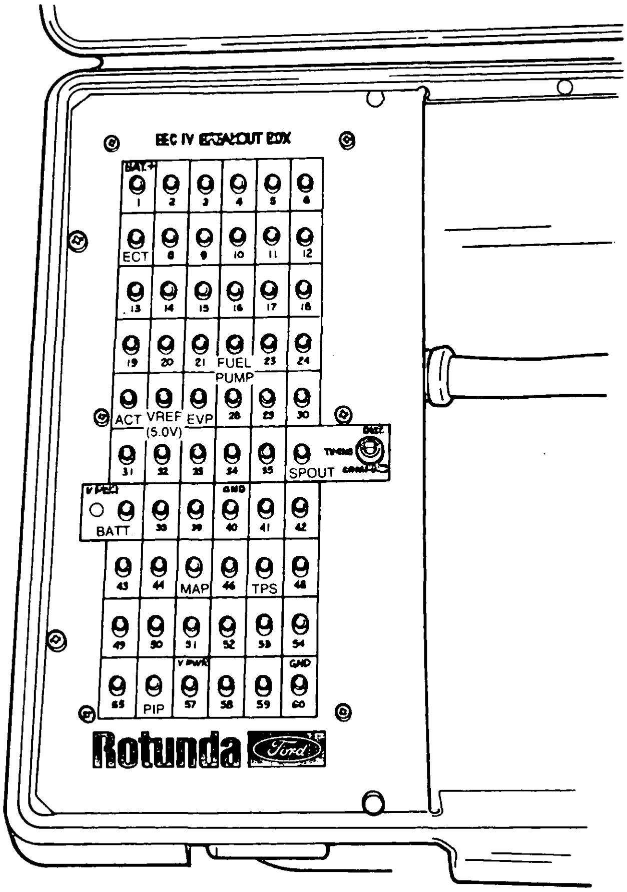
STEPS	POSSIBLE ACTION TO TAKE
• "Tee" a vacuum gauge and extension hose into the EGR valve vacuum line (use a 0-to-100 inches of water vacuum gauge). Install a black STAR tester. Route the STAR tester and vacuum gauge inside the vehicle so you can read them.	


CONTROL VACUUM LINE TO EGR VALVE SHOWN ATTACHED TO VACUUM "TEE"
VACUUM GAUGE HOSE CONNECTED TO VACUUM FITTINGS FOR MANIFOLD VACUUM READING
VACUUM GAUGE HOSE CONNECTED TO EGR VACUUM LINE
TYPICAL EGR VALVE
VACUUM "TEE" CONNECTED IN-LINE BETWEEN EGR CONTROL VACUUM, EGR VALVE, AND VACUUM GAUGE
TO VACUUM GAUGE LOCATED IN PASSENGER COMPARTMENT

STEPS	POSSIBLE ACTION TO TAKE
• Hook up the breakout box with the following key points labeled on the breakout box: — battery voltage — reference voltage — throttle position sensor — PIP signal — ECT sensor — ACT sensor — SPOUT signal — fuel pump (circuit at ECA)	

Intermittent Surging At A Steady Speed

STEPS	POSSIBLE ACTION TO TAKE
ROTUNDA EEC-IV 60-PIN BREAKOUT BOX 014-00322 — WITH KEY PINS LABELED	



- **NOTE: Refer to the correct vehicle "Engine Supplement" Section for the correct pin numbers for the points listed.**

- **NOTE: Before starting the test drive, make sure the line to the fuel pressure gauge and the test equipment wires are properly connected and routed to avoid pinching or crimping.**

- Turn the ignition key to the ON position and watch the fuel pressure gauge. Pressure should increase with the key On and the engine cranking.

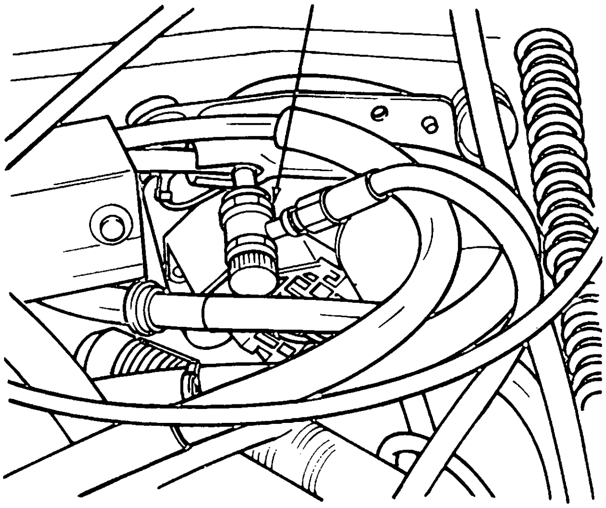
Intermittent Surging At A Steady Speed

STEPS	POSSIBLE ACTION TO TAKE
• Run the engine for three minutes. Then, bump the throttle and watch the vacuum gauge. EGR vacuum should increase momentarily when the throttle is bumped. If vacuum doesn't change, the gauge may not be installed correctly.	• If during the test drive the surge is detected and the readings on the breakout box, vacuum gauge, or fuel pressure gauge differ from the baseline readings, this could be where the problem lies.
• Before going on the test drive, enter the continuous monitor or "wiggle test" mode with the black STAR tester.	• If the STAR tester "beeps" during the test drive, enter the Quick Test and retrieve the memory code. Follow the procedures located in the Quick Test Section.
• With an assistant take the vehicle on a test drive and operate the vehicle in the same way the customer did to try to repeat the intermittent problem.	
• Check and record the sensor and gauge readings at the concern speed with the vehicle running properly. When the vehicle surges, have the assistant note the readings on the gauges and breakout box. Then compare them to the good readings.	

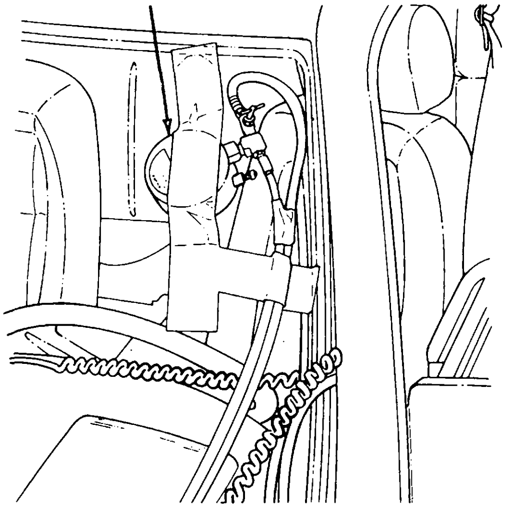
Intermittent Quits On Road And Restarts

STEPS	POSSIBLE ACTION TO TAKE
o Review the repair order. **If required, contact the driver or drivers of the vehicle to get further information. Refer to the Customer Contact Sheet on page 2 of this Section.** o Check for any TSBs that might apply, starting with those that relate to what you observed on the test drive.	o If repair order shows any pattern (e.g., quits on road and restarts occurs whenever the engine is warm or cold), try to duplicate the same condition.
o Visually inspect the engine compartment. **DO NOT disturb anything.**	o If you determine by a visual inspection that anything is disconnected, **do not reconnect the item. If you move any component or connection, you could make it harder to repeat the intermittent problem. NOTE: Look for areas where electrical wires or vacuum lines could be cut by sharp edges or burned by engine hot spots. Blocked or kinked vacuum lines can also cause trouble.**
o Install a fuel pressure gauge with an extension hose that allows you to tape the gauge to the windshield.	o After the test drive, check out any signs of trouble you noted during the test drive. o If the power to the ECA was interrupted, check the circuit for shorts or opens. Also, check the EEC power relay for correct operation. o If there was a loss of fuel pressure, check the fuel pump connections at the fuel pump and fuel pump relay.

ROTUNDA FUEL PRESSURE TESTING GAUGE 014-00447 — TYPICAL HOOK-UP TO FUEL PRESSURE VALVE

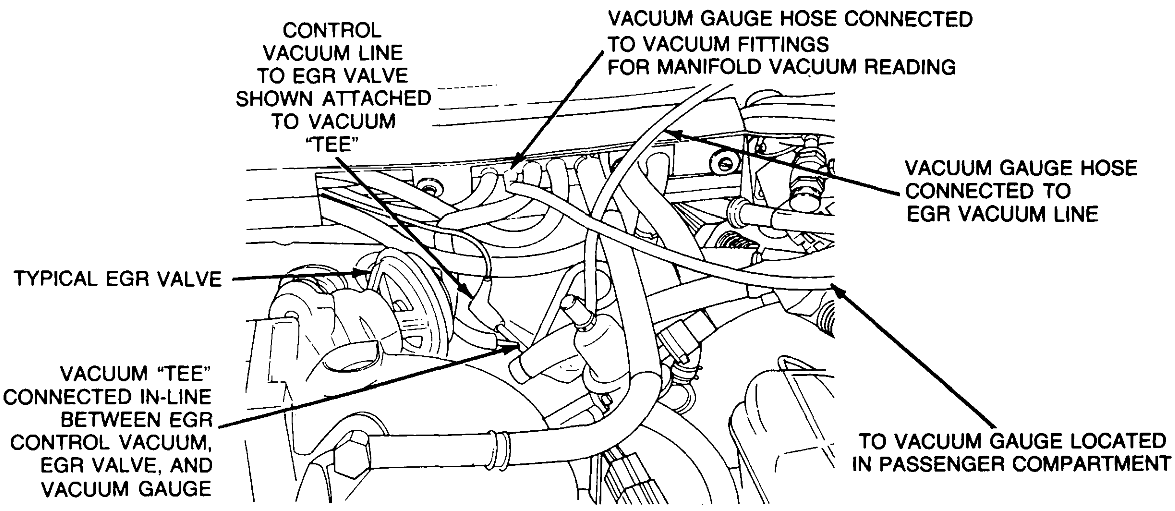


ROTUNDA FUEL PRESSURE TESTING GAUGE 014-00447 — TYPICAL HOOK-UP SHOWING GAUGE TAPED TO OUTSIDE OF WINDSHIELD



Intermittent Quits On Road And Restarts

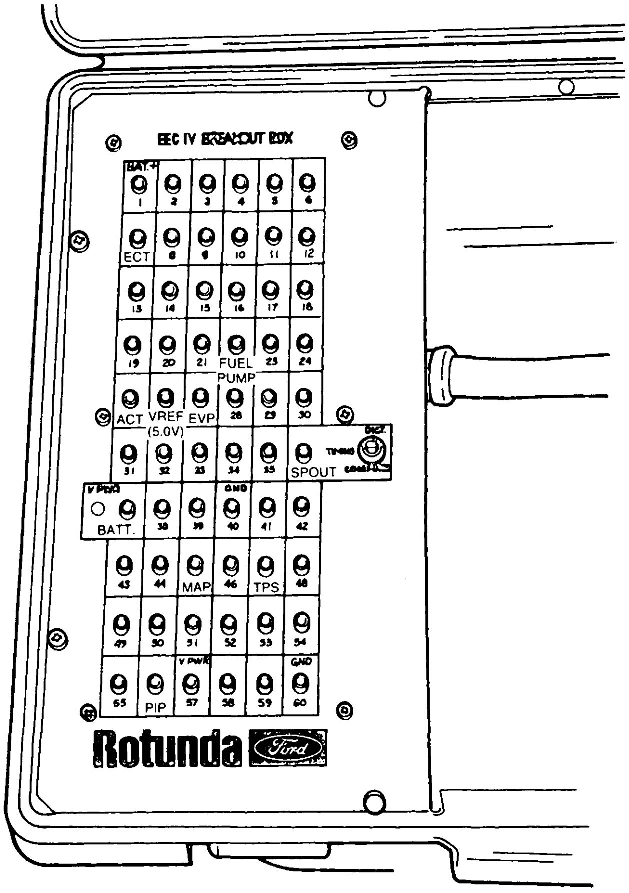
STEPS	POSSIBLE ACTION TO TAKE
NOTE: For 2.3L and 2.5L HSC engines, and other applications without a Schrader Valve installed in the fuel system, use Rotunda Tool D85L-9974-B, In-Line Pressure Tester Adapter. • Install a vacuum gauge and "tee" into the vacuum line to the EGR valve.	


CONTROL VACUUM LINE TO EGR VALVE SHOWN ATTACHED TO VACUUM "TEE"
VACUUM GAUGE HOSE CONNECTED TO VACUUM FITTINGS FOR MANIFOLD VACUUM READING
VACUUM GAUGE HOSE CONNECTED TO EGR VACUUM LINE
TYPICAL EGR VALVE
VACUUM "TEE" CONNECTED IN-LINE BETWEEN EGR CONTROL VACUUM, EGR VALVE, AND VACUUM GAUGE
TO VACUUM GAUGE LOCATED IN PASSENGER COMPARTMENT

STEPS	POSSIBLE ACTION TO TAKE
• Connect a DVOM to monitor the battery power to the ECA during the test drive. • Start the vehicle and verify idle speed, following the procedure in Volume H. • Take the vehicle on a short test drive checking the vacuum and fuel pressure gauges and the DVOM occasionally. • If the vehicle quits, check the gauges and DVOM for any signs of trouble with EGR vacuum, fuel pressure, or battery power to the ECA.	
• If the intermittent fault is still present, refer to Section 2.	**• If after referring to Section 2 and running the Quick Test according to procedures found in this book, the fault is not found, continue to the next step.**

NOTE: Do not continue to the next step unless the Quick Test has not been performed according to procedures outlined in this book, and the intermittent fault has NOT been found.

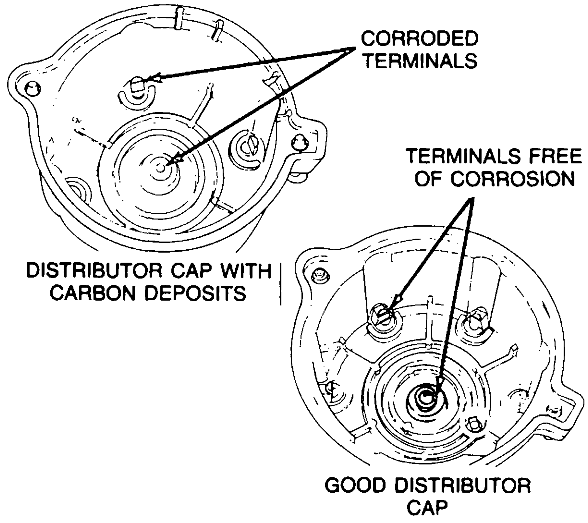
Intermittent Quits On Road And Restarts

STEPS	POSSIBLE ACTION TO TAKE
o If the Quick Test did not find the cause of the intermittent fault, prepare the vehicle for another road test.	o Make a copy of the five-column chart located at the end of this Section and record the readings taken with the ignition key in the ON position and also while the engine was cranking.
o Verify that the fuel pressure gauge is still attached securely to the windshield. Hook up the Black STAR tester and connect the breakout box.	o These are "baseline" readings of key voltages while the engine is operating properly. By comparing these baseline readings with the readings when the intermittent symptom occurs, it is possible to isolate the component or circuit that is at fault.
o Label the following key points on the breakout box: — battery voltage — reference voltage — throttle position sensor — PIP signal — ECT sensor — ACT sensor — SPOUT signal — fuel pump (circuit at ECA)	
ROTUNDA EEC-IV 60-PIN BREAKOUT BOX 014-00322 — WITH KEY PINS LABELED 	

Intermittent Quits On Road And Restarts

STEPS	POSSIBLE ACTION TO TAKE
• **NOTE: Refer to the correct vehicle "Engine Supplement" Section for the correct pin numbers for the points listed.**	
• Test drive the vehicle. If it quits, **do not** touch the ignition key. Coast to the side of the road. • Check the reading obtained on the breakout box with the baseline readings taken before the test drive.	• Perform a Quick Test according to procedures in Volume H.

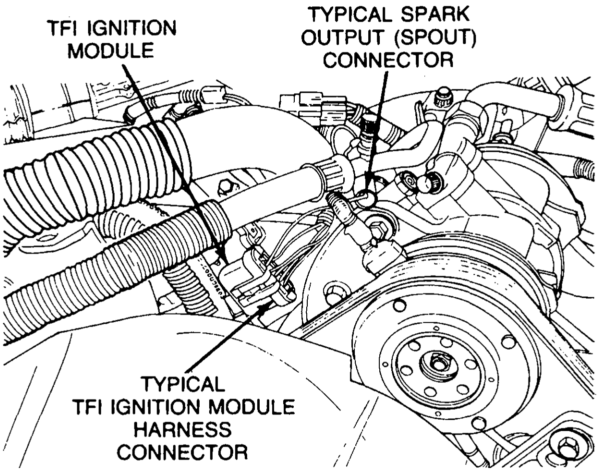
Intermittent Bucking And Jerking

STEPS	POSSIBLE ACTION TO TAKE
o Review the repair order. **If required, contact the driver or drivers of the vehicle to get further information. Refer to the Customer Contact Sheet on page 2 of this Section.**	o If repair order shows any pattern (e.g., vehicle bucks or jerks at a certain speed when the engine is warm or cold), duplicate the condition and try to start the vehicle.
o Visually inspect the engine compartment. **DO NOT disturb anything.**	o If you determine by a visual inspection that anything is disconnected, **do not reconnect the item. If you move any component or connection, you could make it harder to repeat the intermittent problem. NOTE: Look for areas where electrical wires or vacuum lines could be cut by sharp edges or burned by engine hot spots. Blocked or kinked vacuum lines can also cause trouble.**
o Check the ignition system secondary wires for damage or loose connections.	o If ignition system secondary wires are **not** damaged or loose, continue to the next step. o If secondary wires are damaged, replace them and try to duplicate the intermittent fault. o If secondary wires are loose, repair as necessary and try to duplicate the intermittent fault.
o Check distributor cap for moisture, cracks, or salt-like deposits.  CORRODED TERMINALS TERMINALS FREE OF CORROSION DISTRIBUTOR CAP WITH CARBON DEPOSITS GOOD DISTRIBUTOR CAP	o If distributor cap has moisture, find the cause. If necessary, replace the cap. o If distributor cap has cracks or salt-like deposits, replace the cap with a new one. o Start the vehicle and try to duplicate the intermittent fault.
o Check the rotor for damage or burns.	o If rotor is damaged or burned, replace with a new one.

Intermittent Bucking And Jerking

<table>
<tr><th>STEPS</th><th>POSSIBLE ACTION TO TAKE</th></tr>
<tr><td>

- Check the TFI ignition module for damage or loose connections. **NOTE: Do not use the TFI ignition module as a fulcrum for turning the distributor.**


TFI IGNITION MODULE
TYPICAL SPARK OUTPUT (SPOUT) CONNECTOR
TYPICAL TFI IGNITION MODULE HARNESS CONNECTOR

</td><td>

- Replace the TFI ignition module if damaged.

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<tr><td>

- Check the TFI ignition module six-pin connector to ensure it is installed correctly and that the gasket is properly installed and not folded over.

</td><td>

- Repair any loose connections. Reinstall connector if not properly installed.

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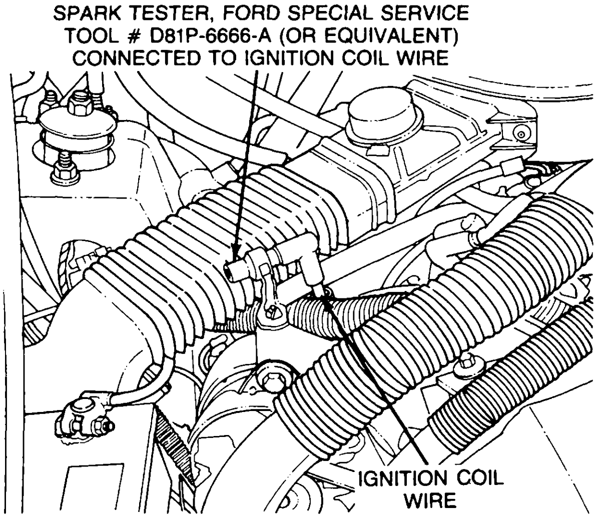
<tr><td>

- Install a spark tester to the ignition system coil wire. **NOTE: Disconnect the wire at the distributor.** Crank the engine.


SPARK TESTER, FORD SPECIAL SERVICE TOOL # D81P-6666-A (OR EQUIVALENT) CONNECTED TO IGNITION COIL WIRE
IGNITION COIL WIRE

</td><td>

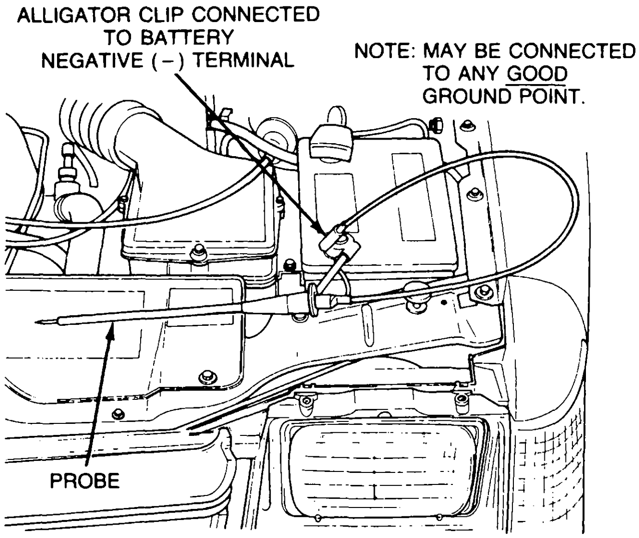
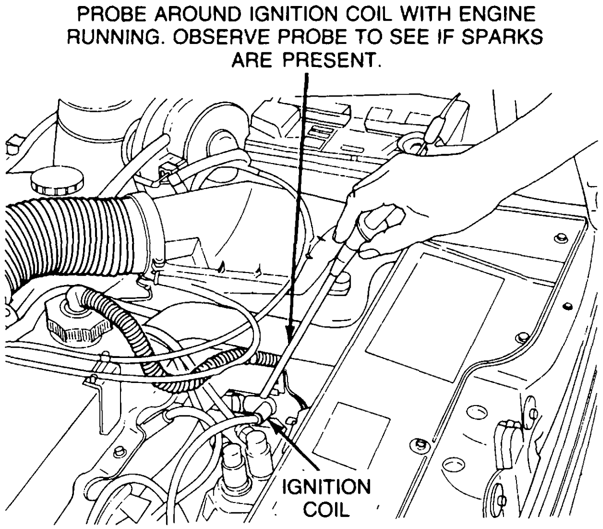
- If a good, strong blue spark is not detected, perform ignition diagnostics according to Ignition Section in Volume H.

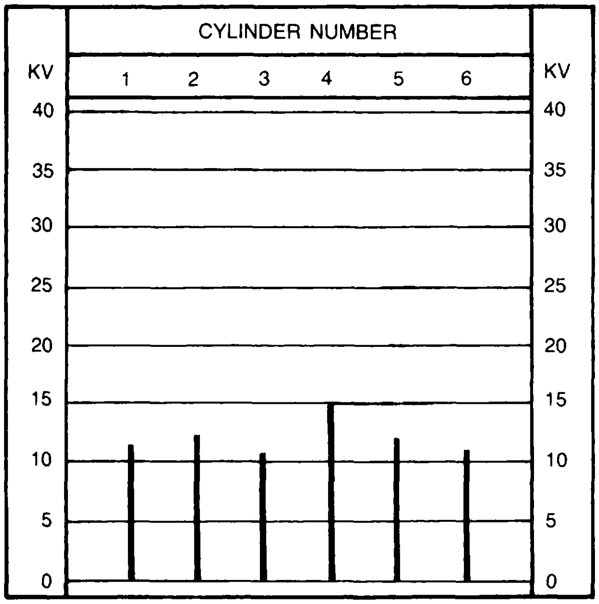
</td></tr>
</table>

Intermittent Bucking And Jerking

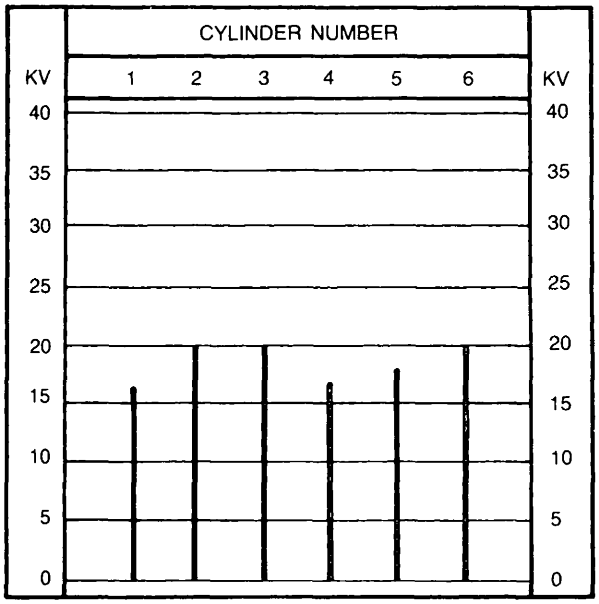
STEPS	POSSIBLE ACTION TO TAKE
o Verify that a good, strong blue spark is observed while the engine is cranking. This indicates that the coil and primary circuit are OK. o **NOTE: By connecting the spark tester to the coil wire, you are able to verify that the coil is firing on each PIP signal.** **NOTE: Never allow the spark from the coil wire to go directly to ground. This could cause internal damage to the coil.**	o If an intermittent spark is present, the ignition coil may be damaged internally.
o With the spark tester still connected to the coil wire, wiggle the ignition primary connectors while cranking the engine. **NOTE: By performing this test while cranking, those circuits dedicated to the start mode are checked.**	o If an intermittent loss of spark is detected, there could be an intermittent open in the TFI ignition module connector or harness that could cause an intermittent bucking and jerking. o **NOTE: An intermittent open in the TFI ignition module or harness could cause an intermittent bucking and jerking by preventing the TFI ignition module from firing the coil at certain times.** o **NOTE: An intermittent open in the coil primary harness or connecter could cause an intermittent bucking and jerking because the coil is not receiving battery voltage.**
o **NOTE: For the following test the engine MUST be running.** Use a jumper wire with an alligator clip at both ends. Attach one of the clips to a **good** ground location. Attach the other end to the metal part of a screwdriver. While the engine is running, pass the screwdriver around the base of the coil. **WARNING: USE CAUTION NOT TO GET THE SCREWDRIVER OR WIRE ENTANGLED WITH THE DRIVE BELTS OF THE VEHICLE.**	o Arcing indicates a breakdown in the insulation of the coil. o Replace the coil.

Intermittent Bucking And Jerking

STEPS	POSSIBLE ACTION TO TAKE
 ALLIGATOR CLIP CONNECTED TO BATTERY NEGATIVE (−) TERMINAL NOTE: MAY BE CONNECTED TO ANY GOOD GROUND POINT. PROBE	 PROBE AROUND IGNITION COIL WITH ENGINE RUNNING. OBSERVE PROBE TO SEE IF SPARKS ARE PRESENT. IGNITION COIL
• Connect an engine analyzer to the vehicle. • Check plug firing voltages, cylinder balance, and base timing.	• If the engine analyzer shows a problem, repair or replace as required.

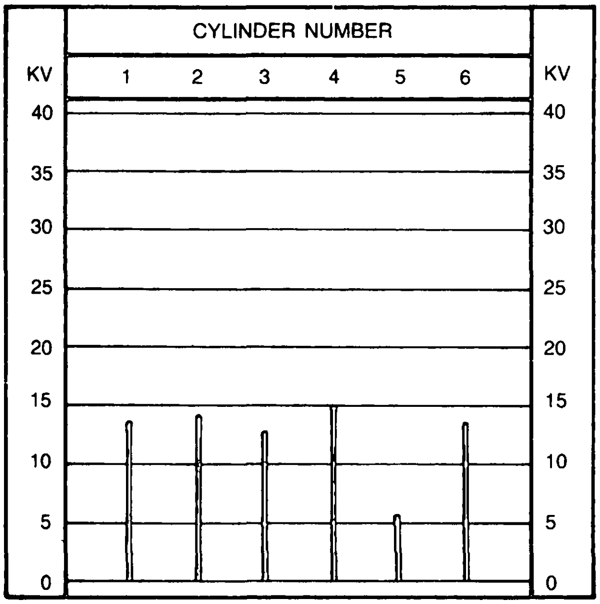


ENGINE ANALYZER DISPLAYS — PROPERLY OPERATING IGNITION SYSTEM

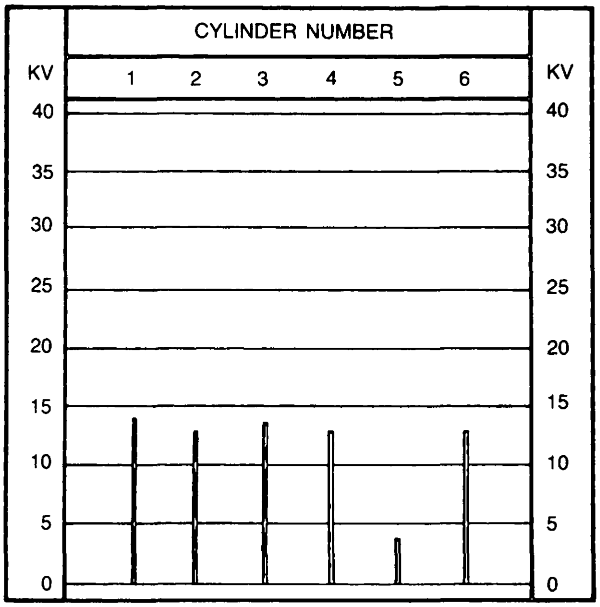


ENGINE ANALYZER DISPLAYS — AVERAGE PLUG FIRING VOLTAGE GREATER THAN 15KV

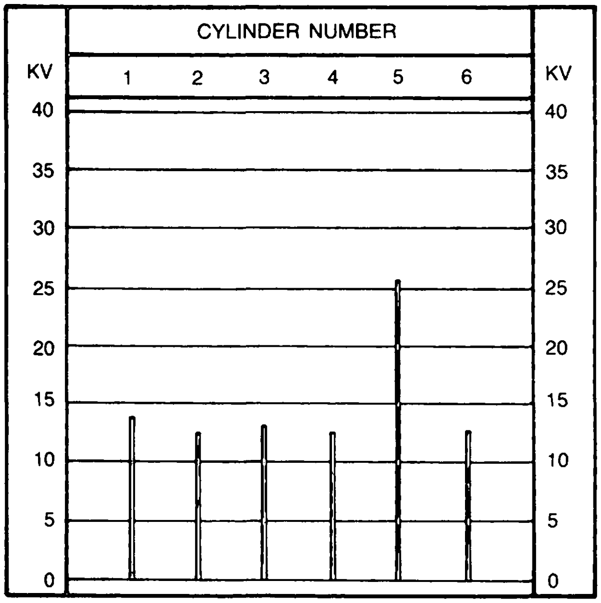
Intermittent Bucking And Jerking



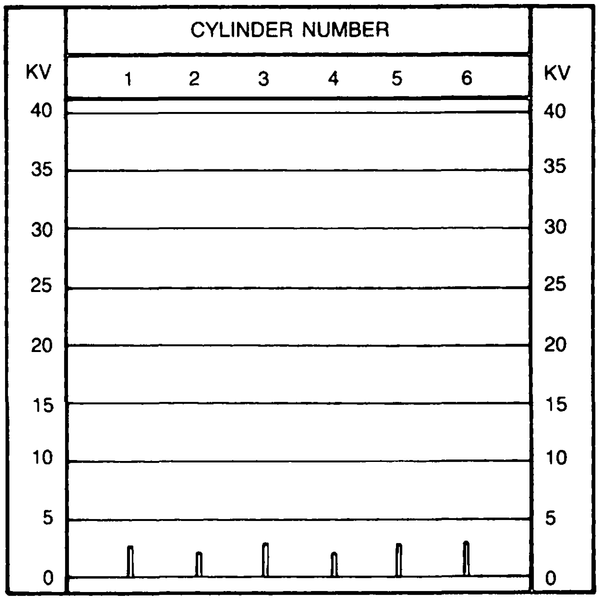
ENGINE ANALYZER DISPLAYS — PLUG FIRING VOLTAGE VARIATION GREATER THAN 5 KV



ENGINE ANALYZER DISPLAYS — LOW PLUG FIRING VOLTAGE IN ONE CYLINDER



ENGINE ANALYZER DISPLAYS — HIGH PLUG FIRING VOLTAGE IN ONE CYLINDER

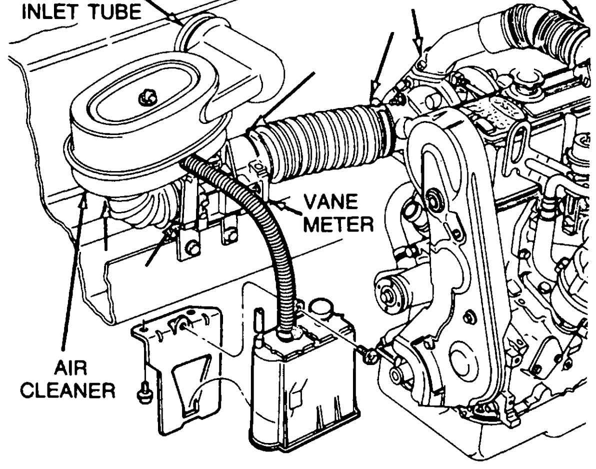


ENGINE ANALYZER DISPLAYS — NEGATIVE FIRING VOLTAGE

Intermittent Bucking And Jerking

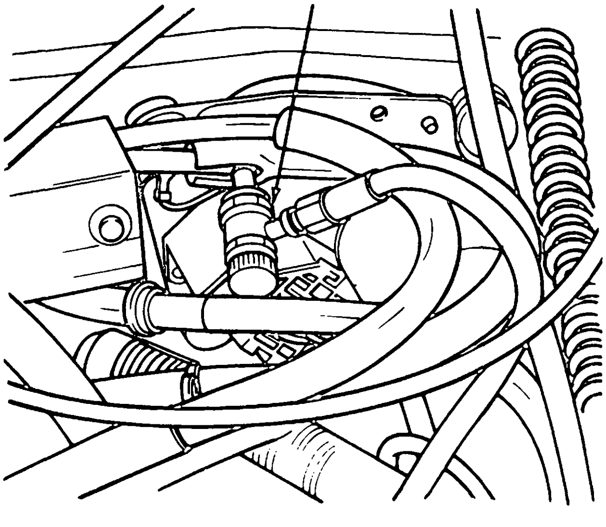
STEPS	POSSIBLE ACTION TO TAKE
• When all tests have been performed on the engine analyzer, check the spark plugs for ash fouling, proper gap, and to make sure they are the right type of plug for the vehicle's engine.	• If the spark plugs are fouled, clean or replace as required. If the spark plugs have an improper gap, regap and install. If the spark plugs are not the correct type, replace with the correct type of plugs. • If the spark plugs check out OK, continue on to the next step.
• **If the intermittent fault is still present, refer to Section 2.**	• **If after referring to Section 2 and running the Quick Test according to procedures found in this book, the fault is not found, continue to the next step.**
NOTE: Do not continue to the next step unless the Quick Test has been performed according to procedures outlined in this book, and the intermittent fault has NOT been found.	
• Connect a MAP/BP tester to either the manifold absolute pressure (MAP) or barometric pressure (BP) sensor (depending on how vehicle is equipped) and check the readings with the engine Off and the ignition key in the ON position. • Compare the reading to the correct value listed on page 50 of this supplement. • If the vehicle is equipped with a MAP sensor, repeat the MAP test with the engine running. The MAP tester reading should decrease at idle and increase when you bump the throttle. **NOTE: If the vehicle is equipped with a barometric pressure (BP) sensor, the engine running portion of the test does not have to be performed since there is no vacuum hookup to the engine.**	• On a vehicle equipped with a MAP sensor, if the reading obtained with the engine OFF and ignition key ON does not match the value given in the Pinpoint Test, perform the appropriate Pinpoint Test in Volume H. • If the MAP sensor does not change when you bump the throttle with the engine running, substitute a known good hose for the original MAP sensor vacuum hose connected to the sensor and repeat the test. A change in the MAP tester reading indicates that the original hose was damaged, blocked or kinked. • On a vehicle equipped with either a MAP or BP sensor, substitute with a known good component and retest. If readings are now OK, replace the component.
NOTE: For 2.3L and 2.5L HSC engines, and other applications without a Schrader Valve installed in the fuel system, use Rotunda Tool D85L-9974-B, In-Line Pressure Tester Adapter. • If the vehicle is equipped with a vane meter, **carefully** check for unmetered air leaks (i.e., loose air tubes, missing hoses or vacuum caps, etc.)	• Correct air or vacuum leaks as necessary.

Intermittent Bucking And Jerking

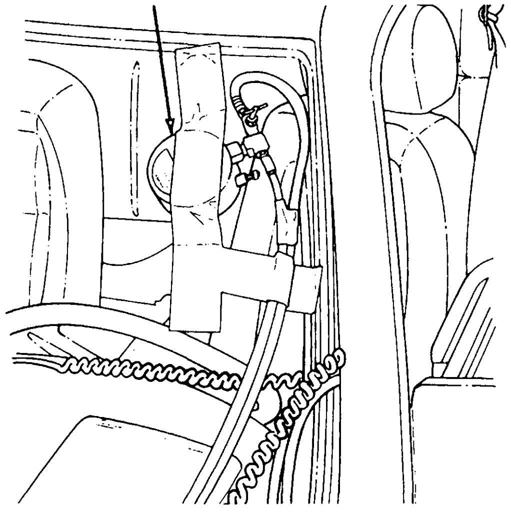

SOME TYPICAL PLACES
TO CHECK FOR AIR LEAKS
ARE SHOWN WITH AN ARROW
(2.3L ENGINE SHOWN — 1.9L SIMILAR)

STEPS	POSSIBLE ACTION TO TAKE
o With the breakout box installed monitor vane meter signal while you manually move the vane meter door through its entire range.	o Voltage must increase smoothly as door is opened. o If not, repair or replace.
o Install a fuel pressure gauge with an extension hose, so that the fuel pressure can be monitored during the test drive. (Tape the fuel pressure gauge to the windshield for easy viewing.)	o Make a copy of the five-column chart at the end of this section and record the readings on the breakout box, vacuum gauge and fuel pressure gauge taken with the ignition key in the ON position while the engine was cranking.

ROTUNDA FUEL PRESSURE TESTING GAUGE 014-00447 —
TYPICAL HOOK-UP TO FUEL PRESSURE VALVE

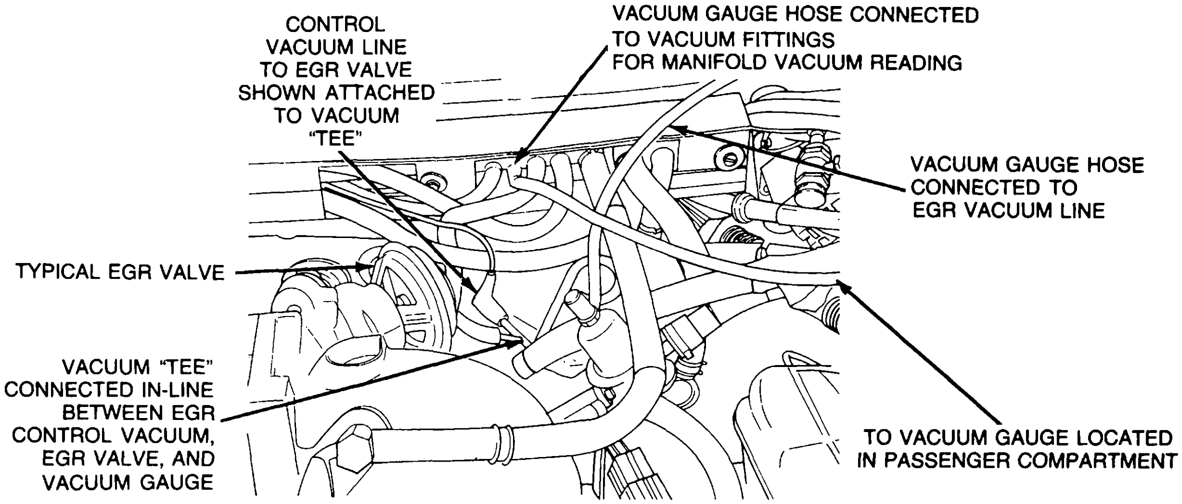


ROTUNDA FUEL PRESSURE TESTING GAUGE
014-00447 — TYPICAL HOOK-UP SHOWING
GAUGE TAPED TO OUTSIDE OF WINDSHIELD



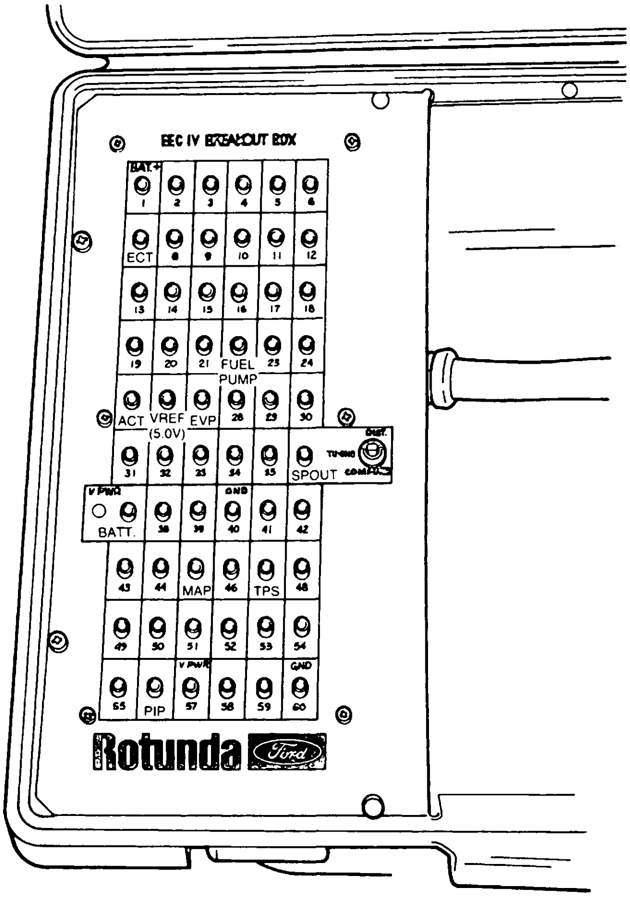
Intermittent Bucking And Jerking

STEPS	POSSIBLE ACTION TO TAKE
• "Tee" a vacuum gauge and extension hose into the EGR valve vacuum line and manifold vacuum line (use a 0-to-100 inches of water vacuum gauge). Install a black STAR tester. Route the STAR tester and vacuum gauges inside the vehicle so you can read them.	• These are "baseline" readings of key voltages, vacuum condition, and fuel pressure while the engine is operating properly. By comparing these baseline readings with the readings when the intermittent symptom occurs, it is possible to isolate the component or circuit that is at fault.


CONTROL VACUUM LINE TO EGR VALVE SHOWN ATTACHED TO VACUUM "TEE"
VACUUM GAUGE HOSE CONNECTED TO VACUUM FITTINGS FOR MANIFOLD VACUUM READING
VACUUM GAUGE HOSE CONNECTED TO EGR VACUUM LINE
TYPICAL EGR VALVE
VACUUM "TEE" CONNECTED IN-LINE BETWEEN EGR CONTROL VACUUM, EGR VALVE, AND VACUUM GAUGE
TO VACUUM GAUGE LOCATED IN PASSENGER COMPARTMENT

STEPS	POSSIBLE ACTION TO TAKE
• Hook up the breakout box with the following key points labeled on the breakout box: — battery voltage — reference voltage — throttle position sensor — PIP signal — ECT sensor — ACT sensor — SPOUT signal — fuel pump (circuit at ECA)	

Intermittent Bucking And Jerking

STEPS	POSSIBLE ACTION TO TAKE
ROTUNDA EEC-IV 60-PIN BREAKOUT BOX 014-00322 — WITH KEY PINS LABELED  EEC IV BREAKOUT BOX BAT.+ ECT FUEL PUMP ACT VREF (5.0V) EVP SPOUT V PWR GND BATT. MAP TPS PIP Rotunda ○ **NOTE: Refer to the correct vehicle "Engine Supplement" Section for the correct pin numbers for the points listed.** ○ **NOTE: Before starting a test drive, make sure the line to the fuel pressure gauge and the test equipment wires are properly connected and routed to avoid pinching or crimping.** ○ Turn the ignition key to ON and watch the fuel pressure gauge. Pressure should increase with the key On and the engine cranking.	
○ Run the engine for three minutes. Then, bump the throttle and watch the vacuum gauge. EGR vacuum should increase momentarily when the throttle is bumped. If vacuum doesn't change, the gauge may not be installed correctly.	○ If during the test drive the fault is detected and the readings on the breakout box, vacuum gauges, or fuel pressure gauge differ from the baseline readings, this could be where the problem lies.

Intermittent Bucking And Jerking

STEPS	POSSIBLE ACTION TO TAKE
• Before going on the test drive, enter the continuous monitor or "wiggle test" mode with the black STAR tester.	• If the STAR tester "beeps" during the test drive, enter the Quick Test and retrieve the memory code. Follow the procedures located in the Quick Test Section.
• Turn the radio to the low end of the AM band. **This checks for internal arcing in the coil, since the arcing would be picked up as noise on the radio.**	
• With an assistant take the vehicle on a test drive and operate the vehicle in the same way the customer did to try repeat the intermittent problem.	
• Check and record the sensor and gauge readings at the concern speed with the vehicle running properly. If the vehicle bucks or jerks, have the assistant note the readings on the gauges and breakout box. Then compare them to the good readings.	

Intermittent Erratic Running/Rough Idle

STEPS	POSSIBLE ACTION TO TAKE
● Review the repair order. **If required, contact the driver or drivers of the vehicle to get further information. Refer to the Customer Contact Sheet on page 2 of this Section.**	○ If repair order shows any pattern (e.g., vehicle idles rough or has erratic engine operation whenever the engine is warm or cold or at a certain speed), try to duplicate the condition.
● Visually inspect the engine compartment. **DO NOT disturb anything.**	○ If you determine by a visual inspection that anything is disconnected, **do not reconnect the item. If you move any component or connection, you could make it harder to repeat the intermittent problem. NOTE: Look for areas where electrical wires or vacuum lines could be cut by sharp edges or burned by engine hot spots. Blocked or kinked vacuum lines can also cause trouble.**
● On EFI (multi-point) engines, check the color at the top of the fuel injectors to see that they are the same.	○ If they are not the same, refer to the chart in this Section to determine the correct color code for the engine being worked on, and replace incorrect injectors with the correct injectors.

Intermittent Erratic Running/Rough Idle

The following charts list fuel injector applications, part numbers, source, color code and injector specifications.

HIGH PRESSURE CFI INJECTOR APPLICATION

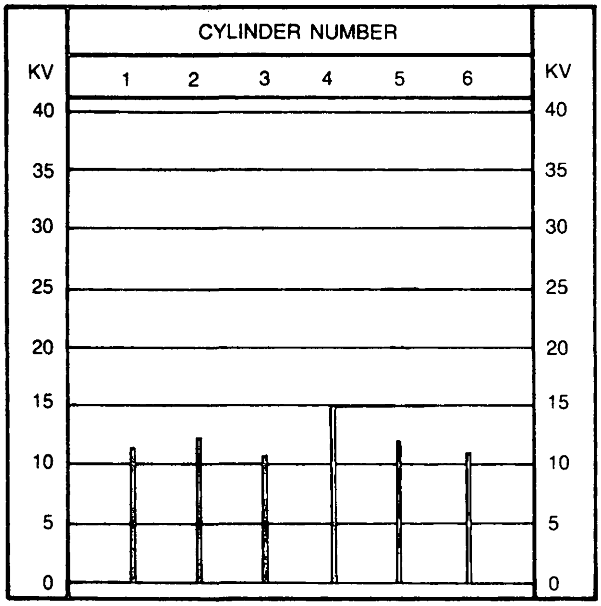
ENGINE APPLICATION	MODEL YEAR	PART NO. - 9F593 -	SOURCE	COLOR CODE	INJECTOR SPECS.	
					SIZE	RESIST
					gm/sec	Ohms
1.6L	1983	E3EE-BA	Bosch	Blue	1.76 (14#/HR)	2.25
	1984	E4EE-AA	N.D.	Blue		2.35
1.6L T/C	1984-85	E4EX-AA	Bosch	Black	3.00 (23#/HR)	2.40
1.9L	1985-1/2-86	E6EE-AB	Bosch	White	2.45 (19#/HR)	2.25
2.3L T/C	1983	E3ZE-BA	Bosch	Green	3.86 (30#/HR)	2.40
	1984	E4ZE-AA	D.K.K.			2.35
	1985	E5ZE-AA	D.K.K.	Brown	4.41 (35#/HR)	2.35
	1986	E5ZE-AB	D.K.K.			
2.3L (Truck)	1985	E59E-AA	N.D.	Gray	1.76 (14#/HR)	16.20
	1986	E59E-AB	N.D.			
2.9L (Car/Truck)	1986	E67C-A1B	Bosch	Gray	1.76 (14#/HR)	14.50
3.0L (Car/Truck)	1986	E59E-AB	N.D.	Gray	1.76 (14#/HR)	16.20
		E67E-BB	Bosch			14.50
3.8 CFI	1984-86	E3VE-A1A	Bosch	Green	4.54 (37#/HR)	2.25
		-A2A	N.D.			2.00
5.0L CFI	1980	EOSE-AA	Bosch	Blue	5.81 (46#/HR)	2.40
	1983	EOSE-A1A	Bosch			2.40
		EOSE-A2A	N.D.			2.00
	1984	EOSE-A1A	Bosch			2.25
		EOSE-A2A	N.D.			2.00
5.0L H.O. CFI	1984-85	E4ZE-CA	Bosch	Gray	6.60 (52#/HR)	2.25
5.0L SEFI	1986	E59E-AB	N.D.	Gray	1.76 (14#/HR)	16.20
		E67E-BB	Bosch			14.50
5.0L H.O. SEFI	1986	E6TE-AB	N.D.	Gold	2.45 (19#/HR)	16.20
5.0L Truck	1985	E5TE-AA	Bosch	Gold	2.45 (19#/HR)	15.50
		E5TE-AA	N.D.			16.20
		E5TE-AA	D.K.K.			16.20
	1986	E5TE-AB	D.K.K.			16.20
		E5TE-BB	Bosch			14.50

LOW PRESSURE CFI INJECTOR APPLICATIONS

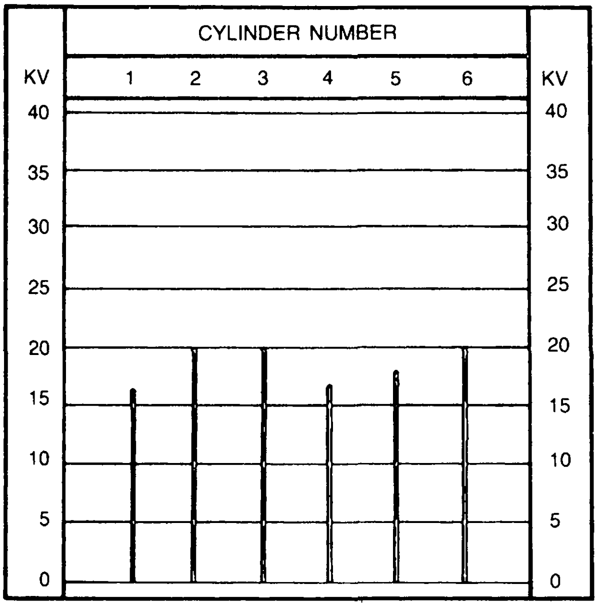
2.3L HSC	1985-86	E43E-AC	Bosch	Blue	7.00 (56#/HR)	1.40
2.3L H.O. HSC (Manual Trans. Only)	1985	E53E-AB	Bosch	Green	8.00 (64#/HR)	1.40
2.5L HSC	1986	E53E-AB	Bosch	Green	8.00 (64#/HR)	1.40

Intermittent Erratic Running/Rough Idle

STEPS	POSSIBLE ACTION TO TAKE
o Check distributor cap for moisture, cracks, or salt-like deposits.	o If distributor cap has moisture, find out the cause. If necessary, replace the cap. o If distributor cap has cracks or salt-like deposits, replace the cap with a new one.
o Connect an engine analyzer to the vehicle. o Check plug firing voltages, cylinder balance, and base timing.	o If the engine analyzer shows a problem, repair or replace as required.

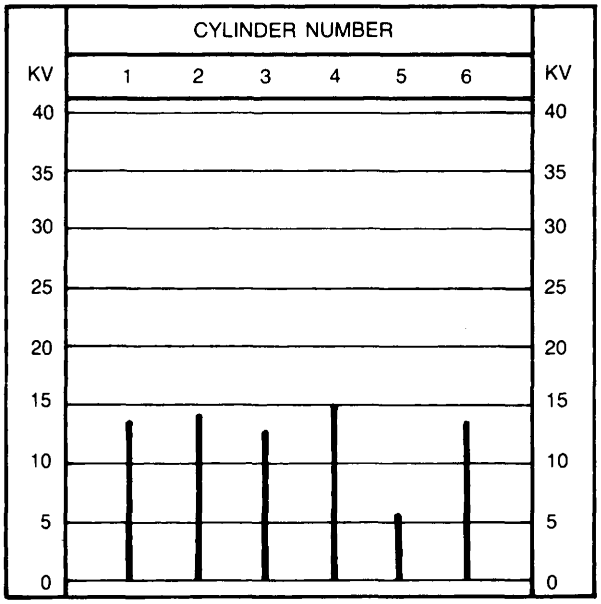


ENGINE ANALYZER DISPLAYS — PROPERLY OPERATING IGNITION SYSTEM

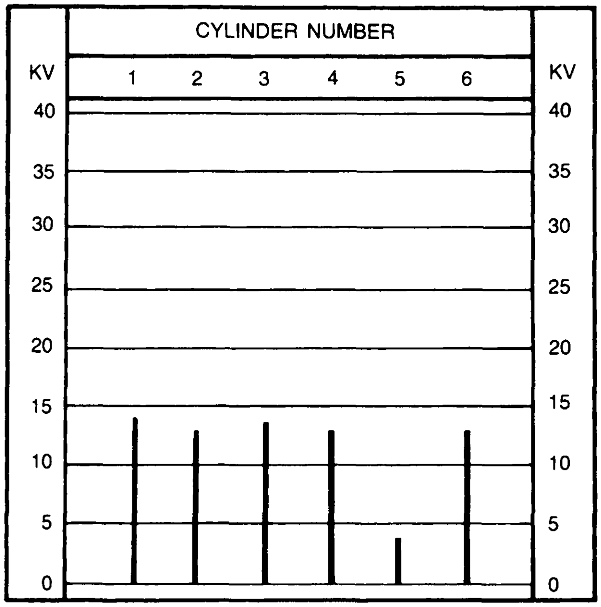


ENGINE ANALYZER DISPLAYS — AVERAGE PLUG FIRING VOLTAGE GREATER THAN 15KV

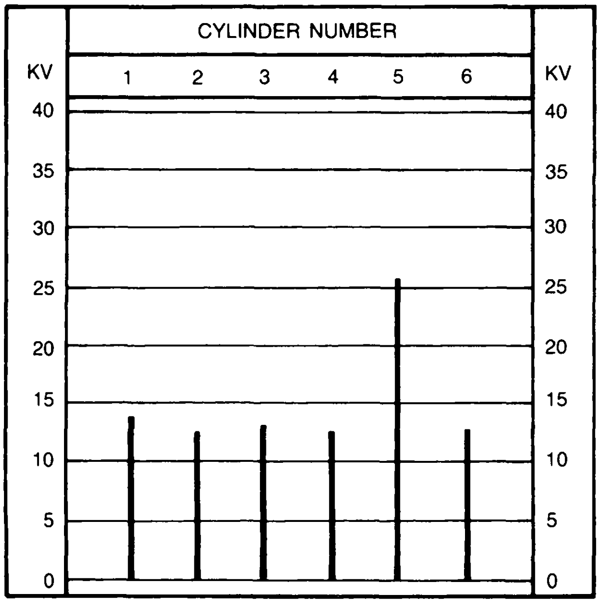
Intermittent Erratic Running/Rough Idle



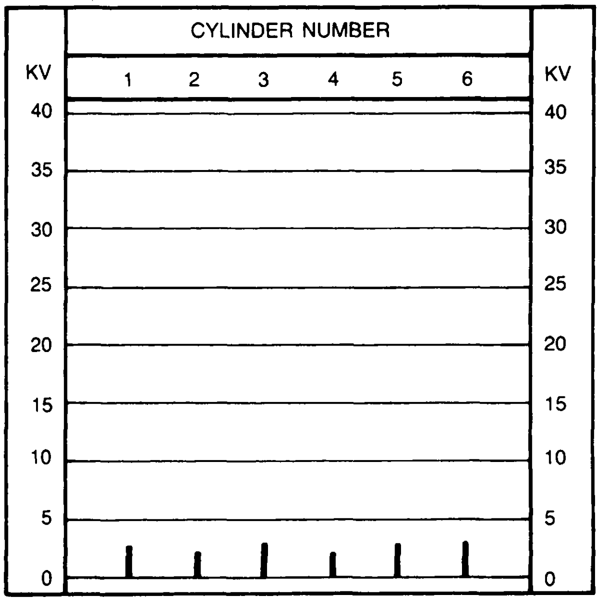
ENGINE ANALYZER DISPLAYS — PLUG FIRING VOLTAGE VARIATION GREATER THAN 5 KV



ENGINE ANALYZER DISPLAYS — LOW PLUG FIRING VOLTAGE IN ONE CYLINDER



ENGINE ANALYZER DISPLAYS — HIGH PLUG FIRING VOLTAGE IN ONE CYLINDER



ENGINE ANALYZER DISPLAYS — NEGATIVE FIRING VOLTAGE

Intermittent Erratic Running/Rough Idle

STEPS	POSSIBLE ACTION TO TAKE
o When all tests have been performed on the engine analyzer, check the spark plugs for ash fouling, proper gap, and to make sure they are the right type of plug for the vehicle's engine. o **NOTE: Do not replace spark plugs at this time.**	o If the spark plugs are fouled, clean or replace as required. If the spark plugs have an improper gap, regap and install. If the spark plugs are not the correct type, replace with the correct type of plugs. o If the spark plugs check out OK, continue to the next step.
o Perform a compression test to check for proper engine and valve train operation.	o If compression check shows a problem, repair or replace as required. o If compression check is OK, continue to the next step.
o Check out the TFI ignition module, profile ignition pickup, and coil by following the TFI-IV worksheet provided in this Section.	o If the TFI worksheet leads to the problem, repair or replace as required.

Intermittent Erratic Running/Rough Idle

TFI — WORKSHEET EEC-IV SYSTEMS — TYPICAL

TO PERFORM THESE TESTS YOU WILL NEED: 12V TESTLITE, DVOM AND A SUPPLY OF STRAIGHT PINS.

NOTE: Prior to starting Step 1, disconnect injectors to prevent flooding engine with fuel.

1. Voltage at positive coil — desired **12V**, actual ____________ (Key On/Engine Off).
2. Voltage at negative coil — desired **12V**, actual ____________ (Key On/Engine Off).

   TESTS 1 and 2 PERFORMED WITH IGNITION KEY ON.

3. Using testlite at negative coil, crank engine, watch that testlite flickers **OK**. If it does not flicker, **problem is indicated. Turn key OFF.**
4. Disconnect coil connector, measure primary and secondary coil resistances, also path to ground.

   Primary coil — .5-1.5 ohms desired, actual ____________.

   Secondary coil — 7K-15K ohms desired, actual ____________.

   Path to ground — ohms infinity desired, actual ____________.

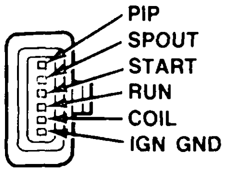
   Reconnect primary and secondary wires.

5. Disconnect TFI module connector at distributor, with DVOM on 20-volt scale.
6. Insert straight pins into connector to measure @ wiring harness:

   "Run" voltage — desired 12V, actual ____________ (Key On/Engine Off).

   "Coil" voltage — desired 12V, actual ____________ (Key On/Engine Off).

   "Start" voltage — desired 8-10V, actual ____________ (engine cranking).



7. Check distributor to engine/block ground — desired 0 ohms, actual ____________.
8. Check TFI module to distributor ground at Pin 6 — desired 0 ohms, actual ____________. Reconnect TFI connector.
9. Check Hall effect device output @ SPOUT harness connector while cranking engine — desired 5-7V, actual ____________ (distributor side of connector).
10. If #9 is not correct, disconnect ECA and redo test at Pin #56 — desired 5-7V, actual ____________. **NOTE: Either a power relay or damaged ECA can cause "no-spark."**
11. If #10 is not correct, check continuity of blue PIP wire to distributor from Pin #56.
12. If #10 is correct, reconnect harness to a substitute processor and redo Step #9.
13. If you do not get 5-7V on SPOUT or PIP wires during crank in any of steps 9-12, Hall effect device in distributor is **probably** shorted.
14. Once you have a good 5-7V PIP signal, if you still do not have pulsating at negative coil the TFI module is bad — provided all the other steps 1-8 are OK. Reconnect injectors.

DO NOT SHORT-CUT THIS TEST — IF YOU DO SO YOU CAN DESTROY A NEW MODULE, A NEW HALL EFFECT DEVICE, A NEW PROCESSOR OR ALL THREE.

Intermittent Erratic Running/Rough Idle

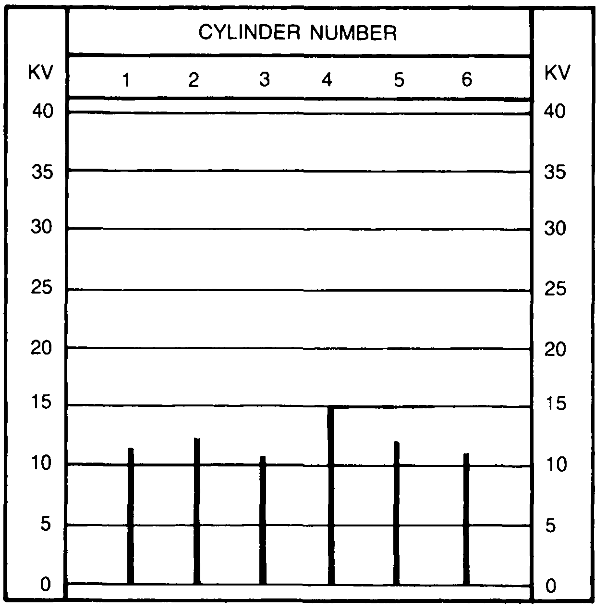
STEPS	POSSIBLE ACTION TO TAKE
o **NOTE: Be sure to use a low-current test light to avoid damaging the electronic control assembly (ECA).**	o If the TFI ignition module, profile ignition pickup, and coil are OK, continue on to the next step.
o Check out the SPOUT connector to ensure it is properly seated.	o If the SPOUT connector is loose, repair or replace as required. o If the SPOUT connector is seated properly, continue to the next step.
o **NOTE: For the following test, the engine MUST be running.** Use a jumper wire with an alligator clip at both ends. Attach one of the clips to a **good** ground location. Attach the other end to the metal part of a screwdriver. While the engine is running, pass the screwdriver around the base of the coil. **WARNING: USE CAUTION NOT TO GET THE SCREWDRIVER OR WIRE ENTANGLED WITH THE DRIVE BELTS OF THE VEHICLE.**	o Arcing indicates a breakdown in the insulation of the coil. If the coil is malfunctioning, the primary circuit could be open intermittently, causing an intermittent no-start condition.
o **If the intermittent fault is still present, refer to Section 2.**	o **If after referring to Section 2 and running the Quick Test according to procedures found in this book, the fault is not found, continue to the next step.**

NOTE: Do not continue to the next step unless the Quick Test has been performed according to procedures outlined in this book, and the intermittent fault has NOT been found.

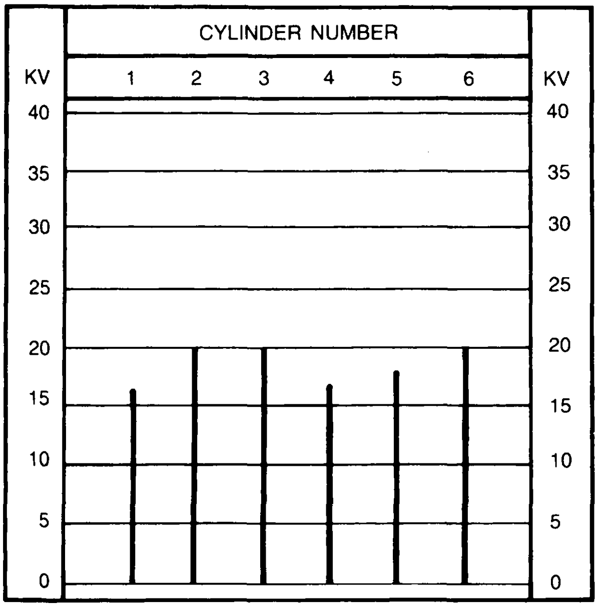
STEPS	POSSIBLE ACTION TO TAKE
o Connect a MAP/BP tester to either the manifold absolute pressure (MAP) or barometric pressure (BP) sensor (depending on how vehicle is equipped) and check the readings with the engine Off and the ignition key in the ON position. o Compare the reading to the correct value listed on page 50 of this supplement. o If the vehicle is equipped with a MAP sensor, repeat the MAP test with the engine running. The MAP tester reading should decrease at idle and increase when you bump the throttle. **NOTE: If the vehicle is equipped with a barometric pressure (BP) sensor, the engine running portion of the test does not have to be performed since there is no vacuum hookup to the engine.**	o On a vehicle equipped with a MAP sensor, if the reading obtained with the engine OFF and ignition key ON does not match the value given in the Pinpoint Test, perform the appropriate Pinpoint Test in Volume H. o If the MAP sensor does not change when you bump the throttle with the engine running, substitute a known good hose for the original MAP sensor vacuum hose connected to the sensor and repeat the test. A change in the MAP tester reading indicates that the original hose was damaged, blocked or kinked. o On a vehicle equipped with either a MAP or BP sensor, substitute with a known good component and retest. If readings are now OK, replace the component.

Intermittent Erratic Running/Rough Idle

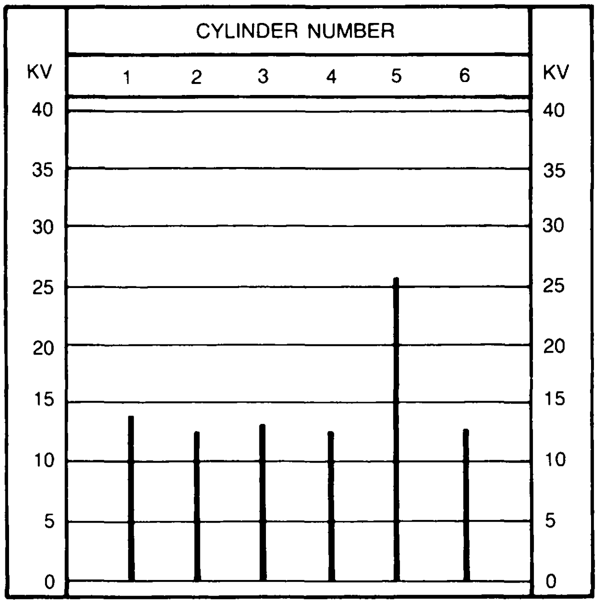
STEPS	POSSIBLE ACTION TO TAKE
• If the vehicle is equipped with a vane meter, **carefully** check for unmetered air leaks (i.e., loose air tubes, missing hoses or vacuum caps, etc.)	• Correct air or vacuum leaks as necessary.



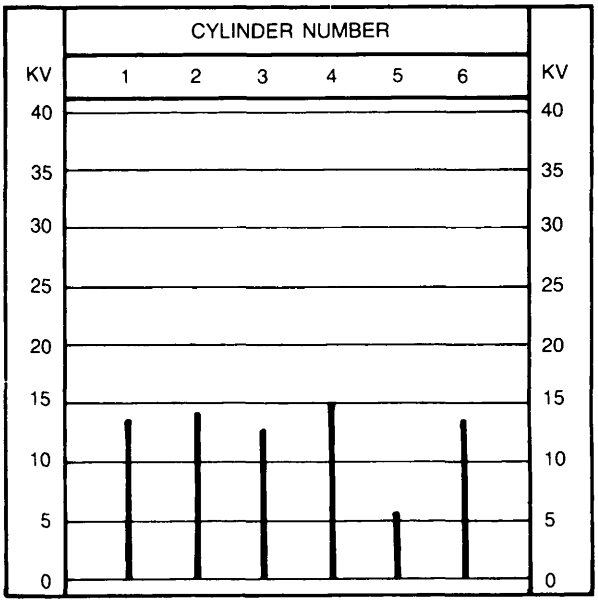
ENGINE ANALYZER DISPLAYS — PROPERLY OPERATING IGNITION SYSTEM



ENGINE ANALYZER DISPLAYS — AVERAGE PLUG FIRING VOLTAGE GREATER THAN 15KV

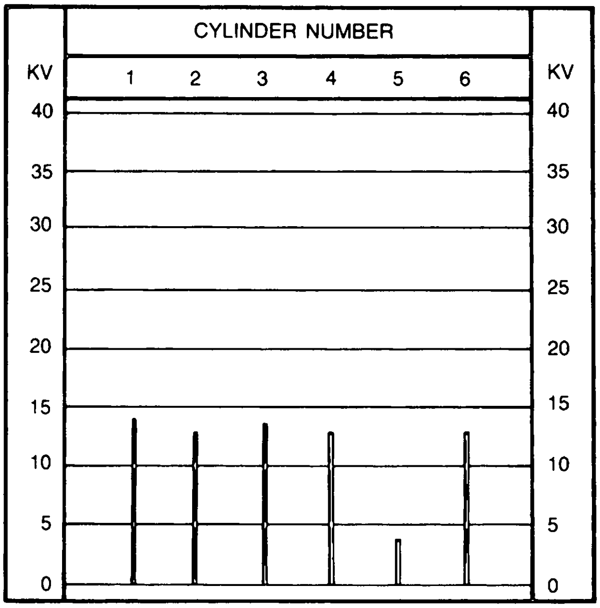
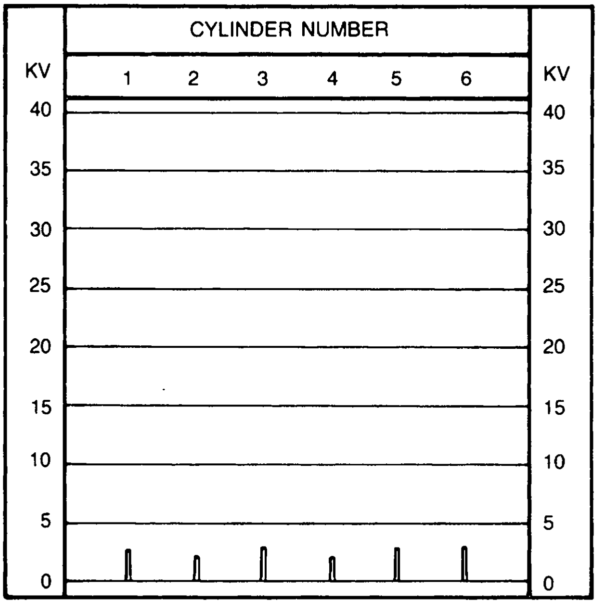


ENGINE ANALYZER DISPLAYS — HIGH PLUG FIRING VOLTAGE IN ONE CYLINDER



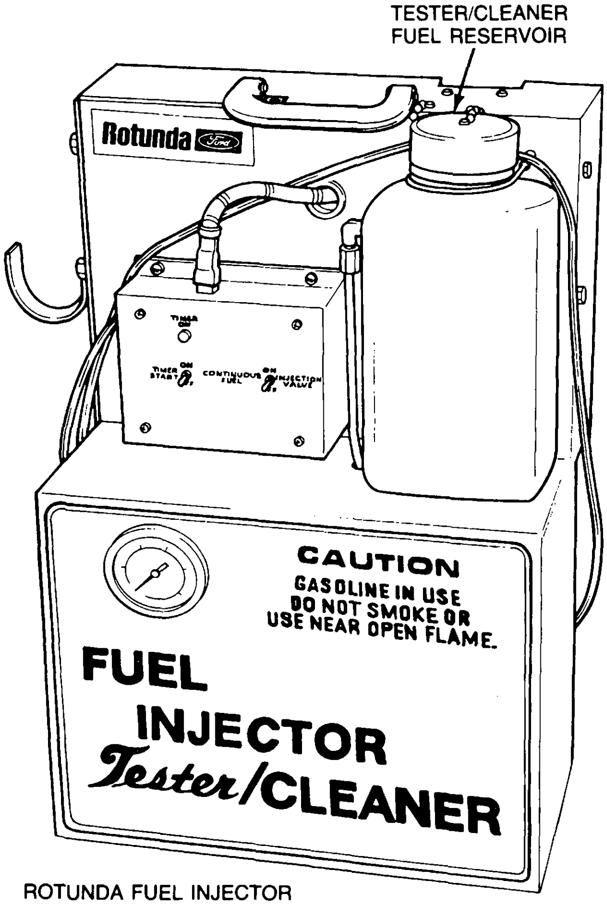
ENGINE ANALYZER DISPLAYS — PLUG FIRING VOLTAGE VARIATION GREATER THAN 5 KV

Intermittent Erratic Running/Rough Idle

STEPS	POSSIBLE ACTION TO TAKE
 ENGINE ANALYZER DISPLAYS — LOW PLUG FIRING VOLTAGE IN ONE CYLINDER	 ENGINE ANALYZER DISPLAYS — NEGATIVE FIRING VOLTAGE
o With breakout box installed monitor vane meter signal while you manually move the vane meter door through its entire range.	o Voltage must increase smoothly as door is opened.
o Connect a Rotunda Fuel Injector Tester/Cleaner to the vehicle according to instructions that come with the unit. o Check the flow of injectors against the specifications given with the Tester/Cleaner and the injector chart located in this test.	o If injector flow is not up to specifications, clean the injectors. Follow the instructions that come with the Tester/Cleaner.

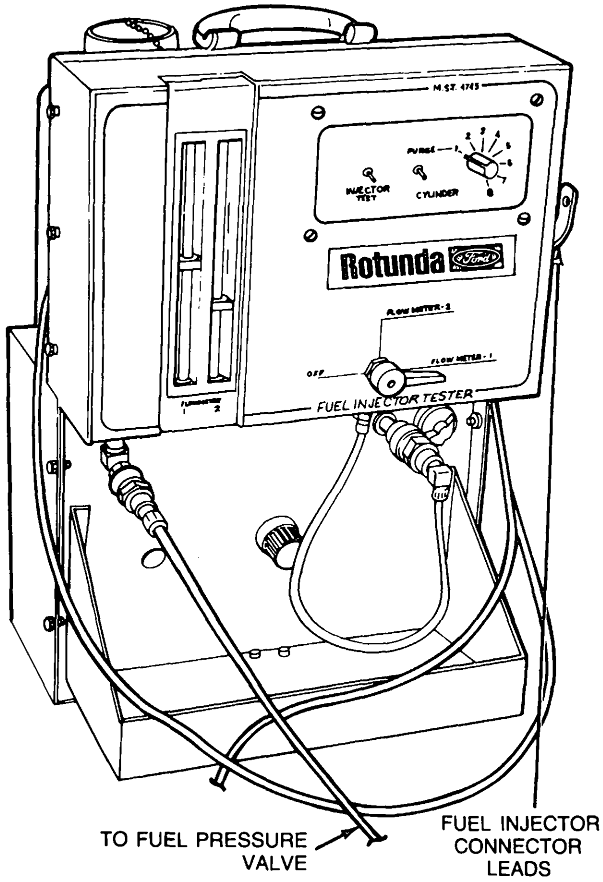
Intermittent Erratic Running/Rough Idle

STEPS	POSSIBLE ACTION TO TAKE



ROTUNDA FUEL INJECTOR TESTER/CLEANER 113-00001

ROTUNDA FUEL INJECTOR TESTER/CLEANER 113-00001 — TYPICAL HOOK-UP TO FUEL INJECTORS AND FUEL PRESSURE VALVE



Intermittent Erratic Running/Rough Idle

The following charts list fuel injector applications, part numbers, source, color code and injector specifications.

HIGH PRESSURE CFI INJECTOR APPLICATION

ENGINE APPLICATION	MODEL YEAR	PART NO. - 9F593 -	SOURCE	COLOR CODE	INJECTOR SPECS.	
					SIZE	RESIST
					gm/sec	Ohms
1.6L	1983	E3EE-BA	Bosch	Blue	1.76 (14#/HR)	2.25
	1984	E4EE-AA	N.D.	Blue		2.35
1.6L T/C	1984-85	E4EX-AA	Bosch	Black	3.00 (23#/HR)	2.40
1.9L	1985-1/2-86	E6EE-AB	Bosch	White	2.45 (19#/HR)	2.25
2.3L T/C	1983	E3ZE-BA	Bosch	Green	3.86 (30#/HR)	2.40
	1984	E4ZE-AA	D.K.K.			2.35
	1985	E5ZE-AA	D.K.K.	Brown	4.41 (35#/HR)	2.35
	1986	E5ZE-AB	D.K.K.			
2.3L (Truck)	1985	E59E-AA	N.D.	Gray	1.76 (14#/HR)	16.20
	1986	E59E-AB	N.D.			
2.9L (Car/Truck)	1986	E67C-A1B	Bosch	Gray	1.76 (14#/HR)	14.50
3.0L (Car/Truck)	1986	E59E-AB	N.D.	Gray	1.76 (14#/HR)	16.20
		E67E-BB	Bosch			14.50
3.8 CFI	1984-86	E3VE-A1A	Bosch	Green	4.54 (37#/HR)	2.25
		-A2A	N.D.			2.00
5.0L CFI	1980	EOSE-AA	Bosch	Blue	5.81 (46#/HR)	2.40
	1983	EOSE-A1A	Bosch			2.40
		EOSE-A2A	N.D.			2.00
	1984	EOSE-A1A	Bosch			2.25
		EOSE-A2A	N.D.			2.00
5.0L H.O. CFI	1984-85	E4ZE-CA	Bosch	Gray	6.60 (52#/HR)	2.25
5.0L SEFI	1986	E59E-AB	N.D.	Gray	1.76 (14#/HR)	16.20
		E67E-BB	Bosch			14.50
5.0L H.O. SEFI	1986	E6TE-AB	N.D.	Gold	2.45 (19#/HR)	16.20
5.0L Truck	1985	E5TE-AA	Bosch	Gold	2.45 (19#/HR)	15.50
		E5TE-AA	N.D.			16.20
		E5TE-AA	D.K.K.			16.20
	1986	E5TE-AB	D.K.K.			16.20
		E5TE-BB	Bosch			14.50

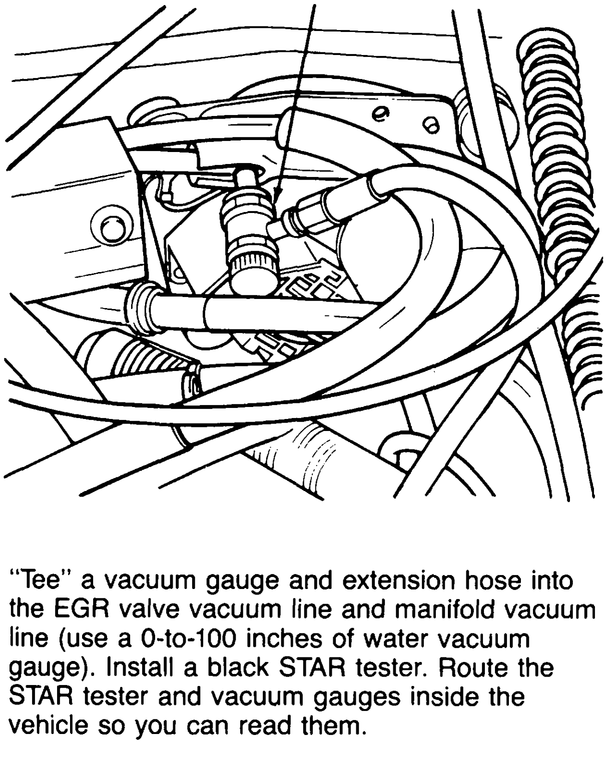
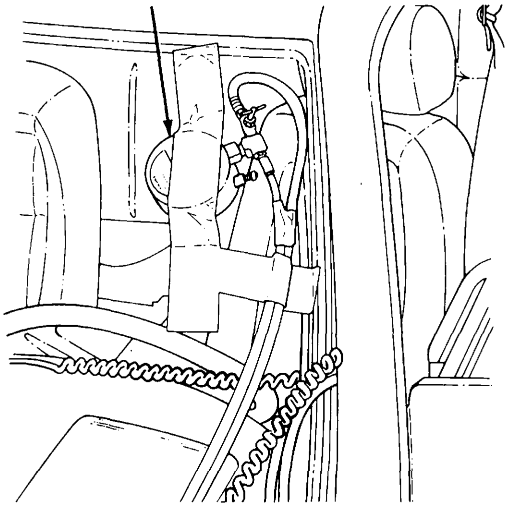
LOW PRESSURE CFI INJECTOR APPLICATIONS

2.3L HSC	1985-86	E43E-AC	Bosch	Blue	7.00 (56#/HR)	1.40
2.3L H.O. HSC (Manual Trans. Only)	1985	E53E-AB	Bosch	Green	8.00 (64#/HR)	1.40
2.5L HSC	1986	E53E-AB	Bosch	Green	8.00 (64#/HR)	1.40

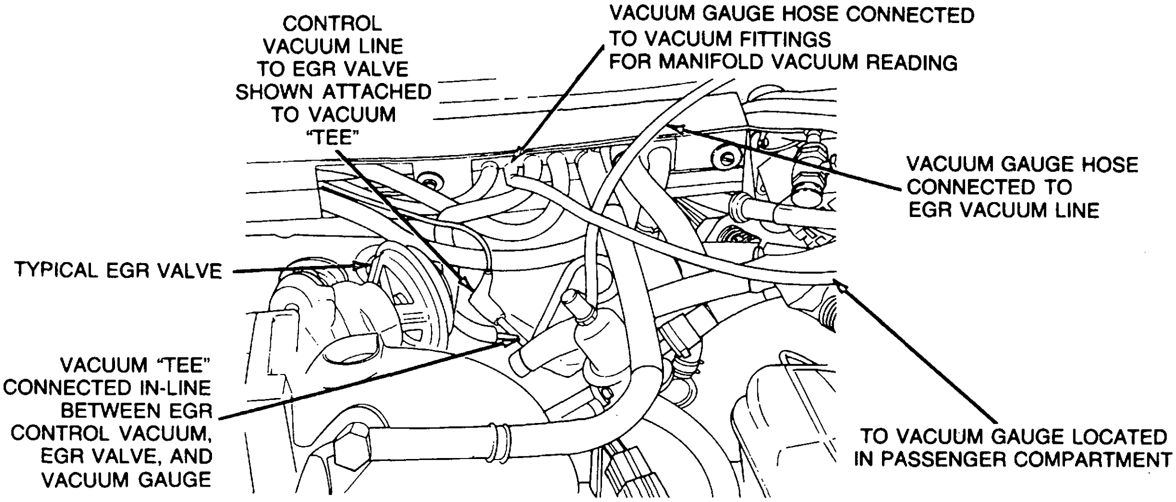
Intermittent Erratic Running/Rough Idle

STEPS	POSSIBLE ACTION TO TAKE
• Check the injector flow again.	• If the injectors still do not meet specifications, replace them.

NOTE: For 2.3L and 2.5L HSC engines, and other applications without a Schrader Valve installed in the fuel system, use Rotunda Tool D85L-9974-B, In-Line Pressure Tester Adapter.

• Install a fuel pressure gauge with an extension hose, so that the fuel pressure can be monitored during the test drive. (Tape the fuel pressure gauge to the windshield for easy viewing.)	• Make a copy of the five-column chart at the end of this section and record the readings on the breakout box, vacuum gauge, and fuel pressure gauge taken with the ignition key in the ON position while the engine was cranking. • These are "baseline" readings of key voltages, vacuum condition and fuel pressure while the engine is operating properly. By comparing these baseline readings with the readings when the intermittent symptom occurs, it is possible to isolate the component or circuit that is at fault.
ROTUNDA FUEL PRESSURE TESTING GAUGE 014-00447 — TYPICAL HOOK-UP TO FUEL PRESSURE VALVE 	ROTUNDA FUEL PRESSURE TESTING GAUGE 014-00447 — TYPICAL HOOK-UP SHOWING GAUGE TAPED TO OUTSIDE OF WINDSHIELD 
• "Tee" a vacuum gauge and extension hose into the EGR valve vacuum line and manifold vacuum line (use a 0-to-100 inches of water vacuum gauge). Install a black STAR tester. Route the STAR tester and vacuum gauges inside the vehicle so you can read them.	

Intermittent Erratic Running/Rough Idle

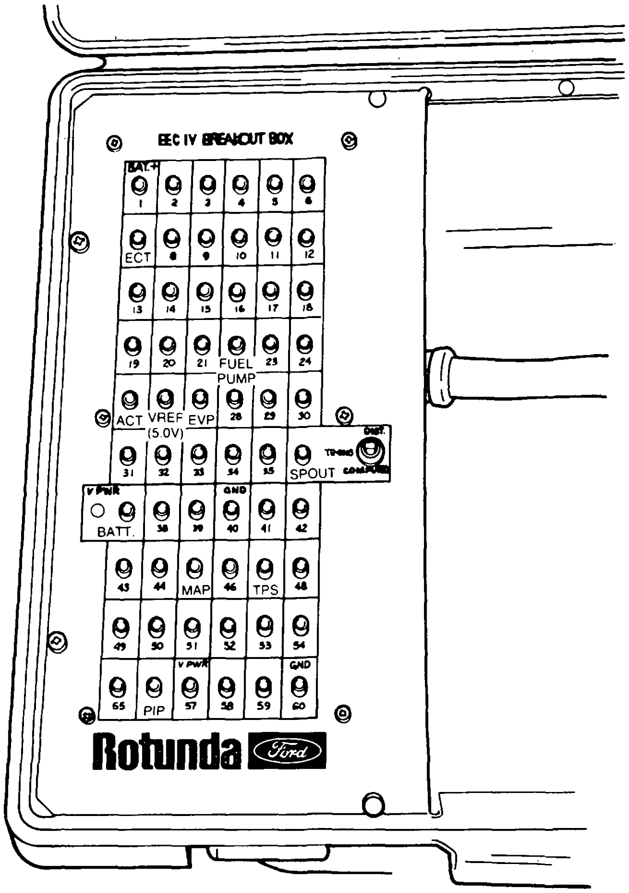

CONTROL VACUUM LINE TO EGR VALVE SHOWN ATTACHED TO VACUUM "TEE"
VACUUM GAUGE HOSE CONNECTED TO VACUUM FITTINGS FOR MANIFOLD VACUUM READING
VACUUM GAUGE HOSE CONNECTED TO EGR VACUUM LINE
TYPICAL EGR VALVE
VACUUM "TEE" CONNECTED IN-LINE BETWEEN EGR CONTROL VACUUM, EGR VALVE, AND VACUUM GAUGE
TO VACUUM GAUGE LOCATED IN PASSENGER COMPARTMENT

STEPS	POSSIBLE ACTION TO TAKE
o Hook up the breakout box with the following key points labeled on the breakout box: — battery voltage — reference voltage — throttle position sensor — PIP signal — ECT sensor — ACT sensor — SPOUT signal — fuel pump (circuit at ECA)	

Intermittent Erratic Running/Rough Idle

STEPS | **POSSIBLE ACTION TO TAKE**

ROTUNDA EEC-IV 60-PIN BREAKOUT BOX 014-00322 —
WITH KEY PINS LABELED



- **NOTE: Refer to the correct vehicle "Engine Supplement" Section for the correct pin numbers for the points listed.**
- **NOTE: Before starting the test drive, make sure the line to the fuel pressure gauge and the test equipment wires are properly connected and routed to avoid pinching or crimping.**
- Turn the ignition key to ON and watch the fuel pressure gauge. Pressure should increase with the key On and the engine cranking.

Intermittent Erratic Running/Rough Idle

STEPS	POSSIBLE ACTION TO TAKE
o Run the engine for three minutes. Then, bump the throttle and watch the vacuum gauge. EGR vacuum should increase momentarily when the throttle is bumped. If vacuum doesn't change, the gauge may not be installed correctly. o Before going on the test drive, enter the continuous monitor or "wiggle test" mode with the black STAR tester. o Turn the radio to the low end of the AM band. **This checks for internal arcing in the coil, since the arcing would be picked up as noise on the radio.** o With an assistant take the vehicle on a test drive and operate the vehicle in the same way the customer did to try to repeat the intermittent problem. o Check and record the sensor and gauge readings at the concern speed with the vehicle running properly. If the engine starts to idle erratically, have the assistant note the readings on the gauges and breakout box. Then, compare them to the good readings.	o If during the test drive the fault is detected and the readings on the breakout box, vacuum gauges, or fuel pressure gauge differ from the baseline readings, this could be where the problem lies. o If the STAR tester "beeps" during the test drive, enter the Quick Test and retrieve the memory code. Follow the procedures located in the Quick Test Section.

Approximate Altitude (Ft.)	Voltage Output (+/− .04 Volts)
0	1.59
1000	1.56
2000	1.53
3000	1.50
4000	1.47
5000	1.44
6000	1.41
7000	1.39

NOTE: Measure several known good MAP sensors on available vehicles. The measured voltage will be typical for your location on the day of testing.

Intermittent Erratic Running/Rough Idle

BASELINE/INTERMITTENT READINGS CHART

BREAKOUT BOX KEYPOINTS	KEY ON/ ENGINE OFF	CRANKING	AT IDLE	TROUBLE POINT*	**
Battery Voltage (BATT)					
Reference Voltage (VREF)					
Throttle Position Sensor (TPS)					
Profile Ignition Pickup (PIP)					
Engine Coolant Temperature (ECT)					
Air Charge Temperature (ACT)					
Spark Output (SPOUT)					
Fuel Pump (FP)					

*At trouble point, i.e., jerks, bucks at 30 mph, etc.
**This column can be used as required.

OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS

ORDERING INFORMATION
A special order form is included in the back of this manual for your convenience if you desire to order.

ENGINE EMISSIONS FACTS BOOK

- The manual contains complete specifications for each calibration number.
- Published at the conclusion of the model year.

ELECTRICAL & VACUUM TROUBLESHOOTING MANUAL (EVTM)

- Available for all passenger car and light truck vehicles, this publication provides schematics of all electrical and vacuum circuits. Wiring diagrams show how the circuit is powered. Troubleshooting hints are provided to point the technician in a general direction but are not step by step procedures.
- Available in the first quarter of the model year. (One manual for each passenger car and light truck family.)

WIRING & VACUUM DIAGRAMS

- This publication contains wiring diagrams for all Ford and Lincoln/Mercury passenger car and light truck vehicles. A Power Distribution system illustrates the power distribution throughout each vehicle. In addition, all individual electrical circuits are shown for each vehicle line.
- Available in the first quarter of the model year.

Service Specifications Manuals

(CAR AND TRUCK)

- These manuals contain all specifications including maintenance and lubrication contained in the Shop Manuals in a handy pocket size for easy reference.
- Available in the first quarter of the model year.

ENGINE/EMISSIONS DIAGNOSIS

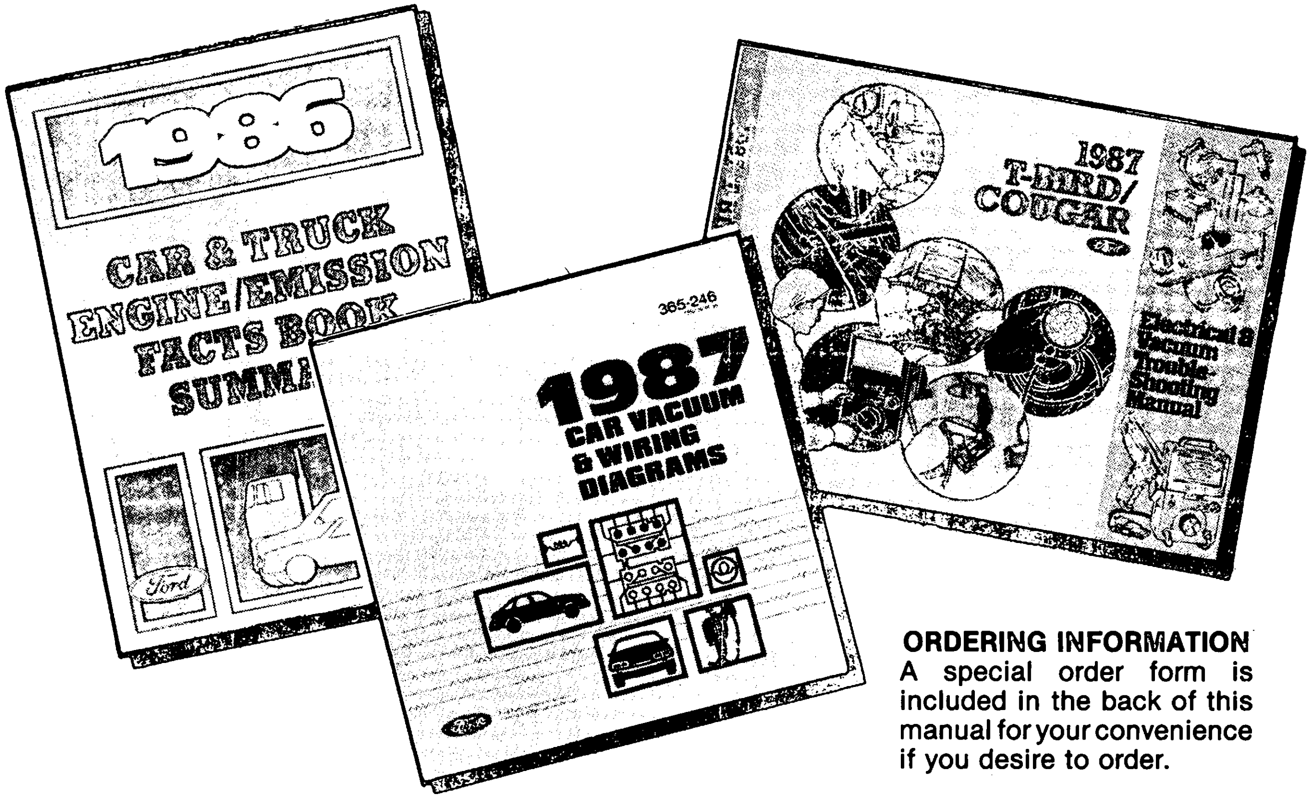
Contents

PART IV—DIESEL ENGINES SECTION

Diesel Diagnostics—2.0L Engine 21
Diesel Diagnostics—2.3L Turbo Engine 22
Diesel Diagnostics—6.6L and 7.5L Engines 23
Diesel Diagnostics—6.9L Engine 24

OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS


1986
CAR & TRUCK ENGINE/EMISSION FACTS BOOK SUMM
Ford
365-246
1987
CAR VACUUM & WIRING DIAGRAMS
1987
T-BIRD/
COUGAR
Electrical & Vacuum Trouble-Shooting Manual

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SECTION 21

Diesel Diagnostics—2.0L Engine

Contents

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Test Equipment 21-2

Idle Speed Setting Procedures 21-7

Injection Timing—Setting 21-8

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Symptom Analysis 21-20

Glow Plug Control System Diagnosis 21-25

Engine Performance Diagnosis 21-30

Injection Nozzle Testing 21-38

Preliminary Checkout

This Section covers the adjustment, diagnostic, and test procedures for the 2.0L diesel engine Quick Start and Afterglow System, and Fuel Injection System.

Checkout

- Visually inspect the engine compartment to ensure all wiring harnesses and fuel lines are properly routed and securely connected.
- Examine all wiring harnesses and connectors for insulation damage, burned, overheated, loose or broken conditions.
- Be certain the battery is fully charged.
- All accessories should be Off during testing and diagnosis.

Test Equipment

The following test equipment (Figs. 1 through 4) is required for adjusting idle speed and timing.

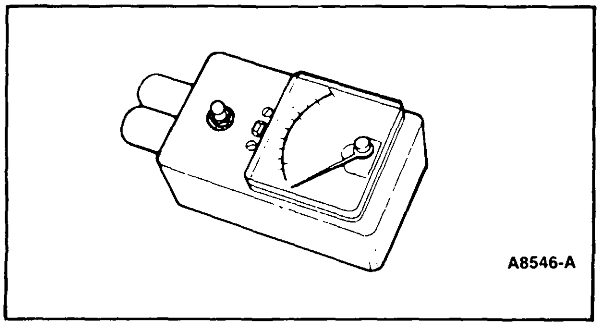


Figure 1 Rotunda 099-00001 Photoelectric Tachometer (For Engine RPM Checking Only)

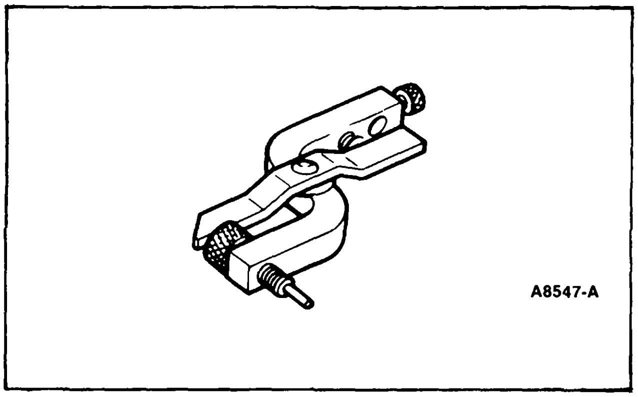


Figure 2 Rotunda 014-00303 Static Timing Gauge Adapter (D83T-9000-D)

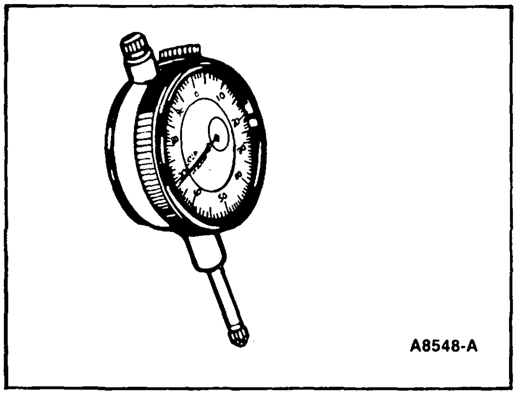


Figure 3 D82L-4201-A Metric Dial Indicator

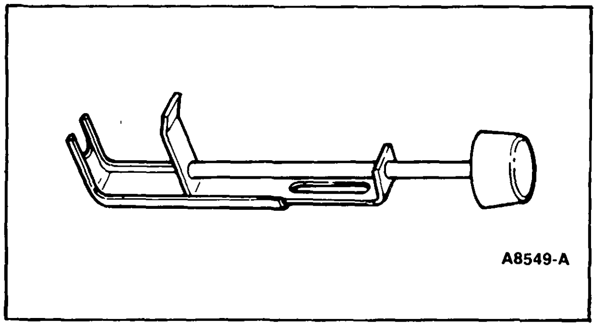


Figure 4 Rotunda 014-00302 Throttle Control (D83T-9000-E)

Test Equipment

The following test equipment (Figs. 5 through 9) is required for adjusting engine timing.

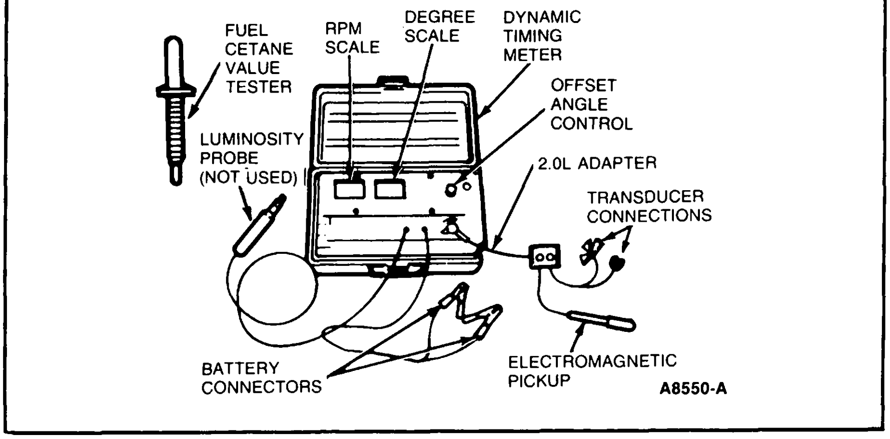


Figure 5 Rotunda 078-00100 Dynamic Timing Meter with 2.0L Rotunda Adapter Kit 078-00124

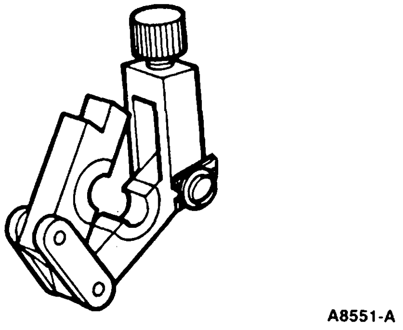


Figure 6 Fuel Line Pressure Transducer

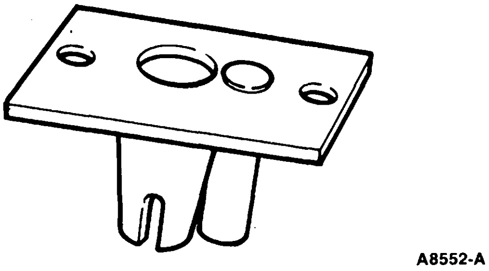


Figure 7 Electromagnetic Pickup Adapter

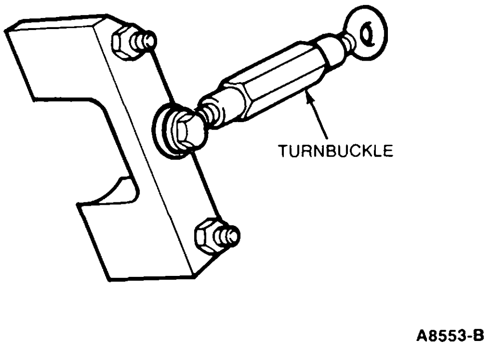


Figure 8 Rotunda 014-00413 Injection Pump Rotating Tool

Test Equipment

The following test equipment (Fig. 9) is required for performing the Engine Performance Diagnostic Procedure.

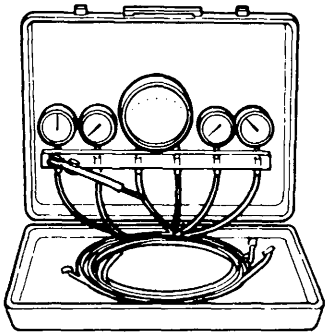


Figure 9 Rotunda 014-00702

Test Equipment

The following test equipment (Figs. 10 and 11) is required for performing the WAIT TO START Lamp Diagnostic Procedure and the Fast Start Glow Plug System Diagnostic Procedure.

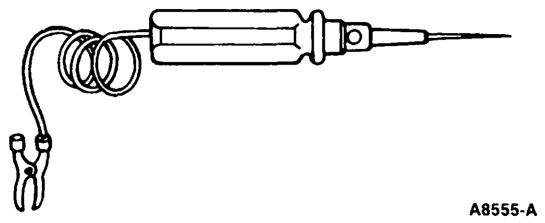


Figure 10 12 Volt Test Lamp

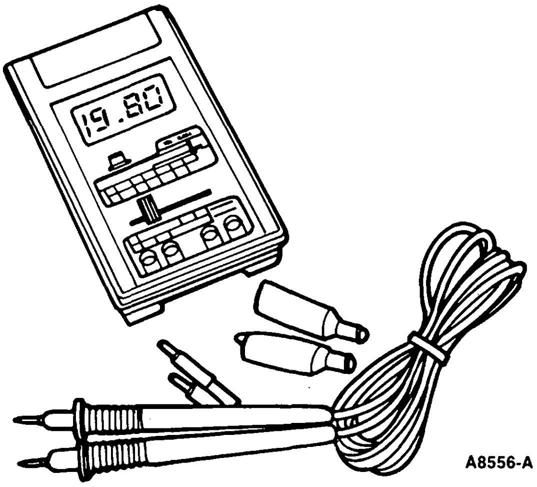


Figure 11 Rotunda 007-00001 Digital Multimeter

Test Equipment

The following test equipment (Figs. 12 and 13) is required for Injection Nozzle testing and cleaning.

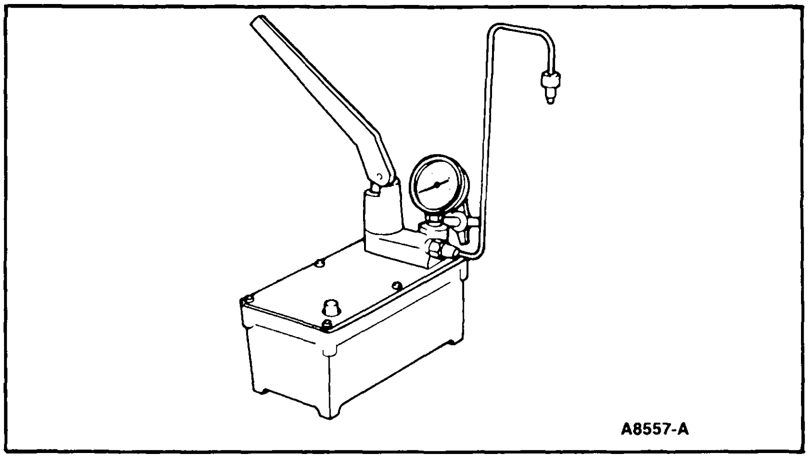


Figure 12 Rotunda 014-00300 Injector Nozzle Tester

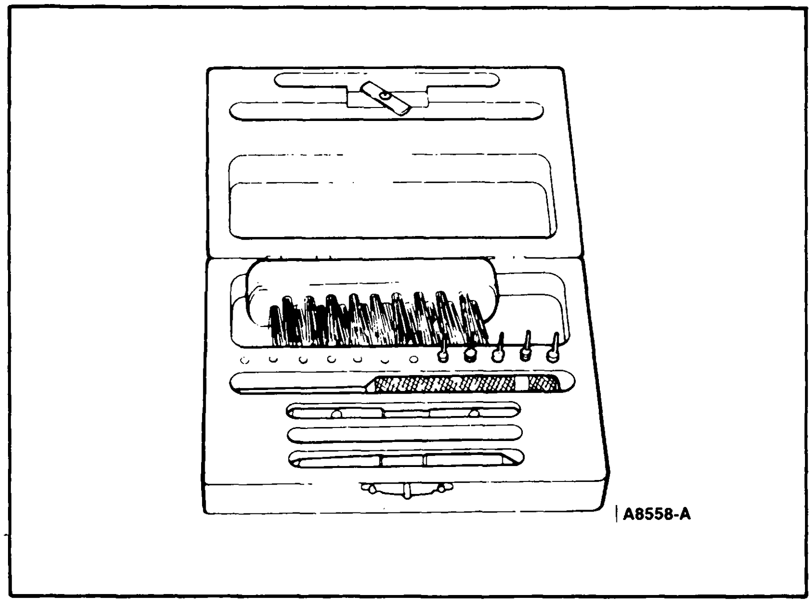


Figure 13 Rotunda 014-00301 Injector Nozzle Cleaning Kit

Idle Speed Setting Procedures

Curb Idle Speed Adjustment

1. Place transmission in NEUTRAL.
2. Bring engine up to normal operating temperature. Stop engine.
3. Remove timing hole cover. Clean flywheel surface and install reflective tape.
4. Idle speed is measure with manual transmission in NEUTRAL.
5. Check curb idle speed, using Rotunda 099-00001 or equivalent. Curb idle speed is specified on the Vehicle Emissions Control Information (VECI) decal. Adjust to specification by loosening lock nut on idle speed bolt. Turn idle speed adjusting bolt clockwise to increase, or counterclockwise to decrease engine idle speed. Tighten lock nut (Fig. 14).
6. Place transmission in NEUTRAL. Rev engine momentarily and recheck curb idle rpm. Readjust if necessary.
7. Turn A/C On. Check idle speed. Adjust to specification by loosening nut on A/C throttle kicker and rotating screw (Fig. 14).

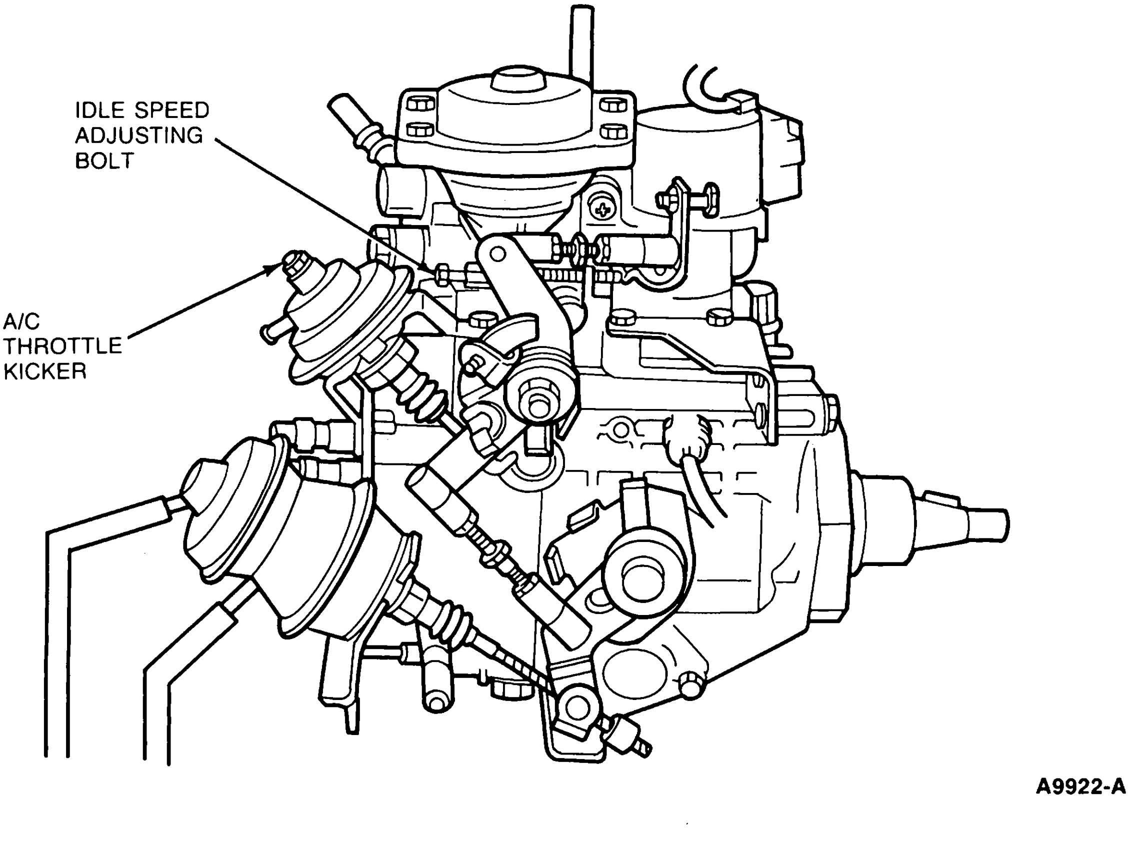


Figure 14 Adjusting Idle Speed

Fast Idle Adjustment

Refer to Cold Start Device Diagnosis in this Section.

Setting Injection Timing — Static

NOTE: Engine coolant temperature must be above 80°C (176°F) before injection timing can be checked and/or adjusted.

1. Disconnect battery ground cable from battery, located in luggage compartment.
2. Remove injection pump distributor head plug bolt and sealing washer.
3. Install Static Timing Gauge Adapter, Rotunda 014-00303, with Metric Dial Indicator, D82L-4201-A or equivalent so that indicator pointer is in contact with injection pump plunger (Fig. 15).
4. Remove timing mark cover from transmission housing. Align timing mark (TDC) with pointer on rear engine cover plate (Fig. 16).
5. Rotate crankshaft pulley slowly, counterclockwise until dial indicator pointer stops moving (approximately 30 -50 degrees BTDC).

   NOTE: There is a 40° BTDC timing mark on flywheel.
6. Adjust dial indicator to Zero.

   NOTE: Confirm that dial indicator pointer does not move from Zero by slightly rotating crankshaft left and right.
7. Turn crankshaft clockwise until crankshaft timing mark aligns with indicator pin (Fig. 16). Dial indicator should read 1 ± 0.02mm (0.04 ± 0.0008 inch). If reading is not within specification, adjust as follows:
   - a. Loosen injection pump attaching bolt and nuts.
   - b. Rotate injection pump toward the engine to advance timing and away from the engine to retard timing. Rotate injection pump until dial indicator reads 1 ± 0.02mm (0.04 ± 0.0008 inch) (Fig. 15).
   - c. Tighten injection pump attaching nuts and bolt to 18-27 N•m (13-20 lb-ft).
   - d. Repeat Steps 5, 6 and 7 to check that timing is adjusted correctly.
8. Remove dial indicator and adapter and install injection pump distributor head plug and tighten to 13.5-19.5 N•m (10-14.5 lb-ft).
9. Connect battery ground cable to battery.
10. Run engine and check and adjust idle rpm, if necessary. Check for fuel leaks.

Setting Injection Timing — Static

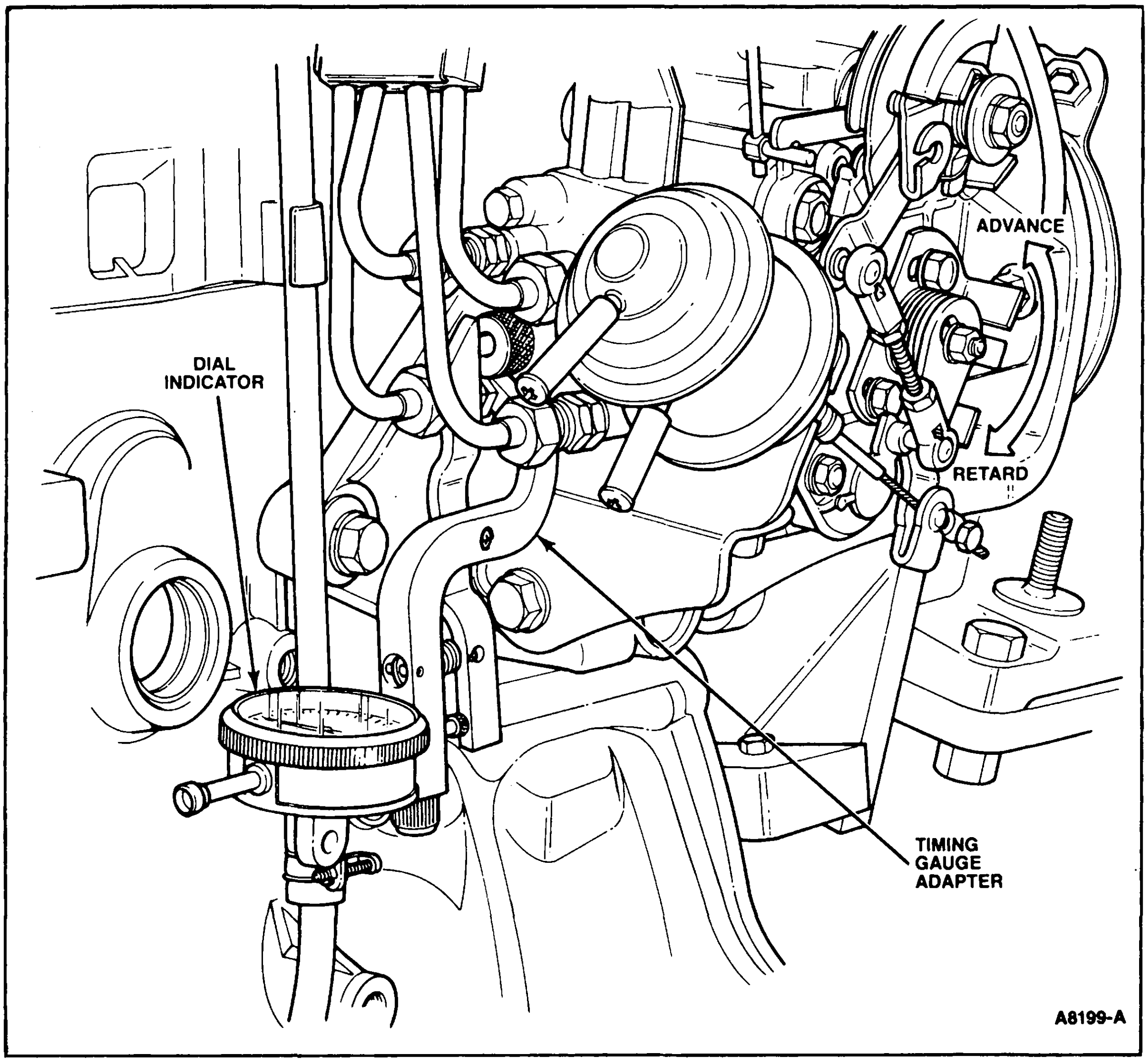


Figure 15 Installing Timing Gauge

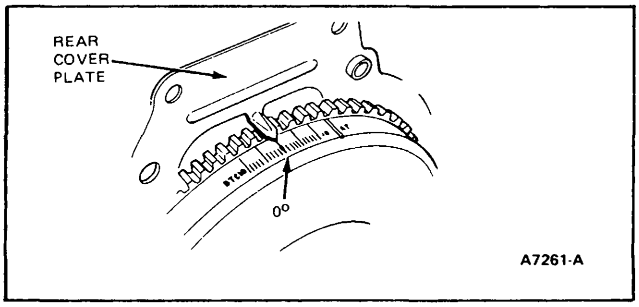


Figure 16 Flywheel Timing Mark

Setting Injection Timing — Dynamic

1. Completely clean the indicated portion of No. 1 high pressure fuel line (Fig. 17).

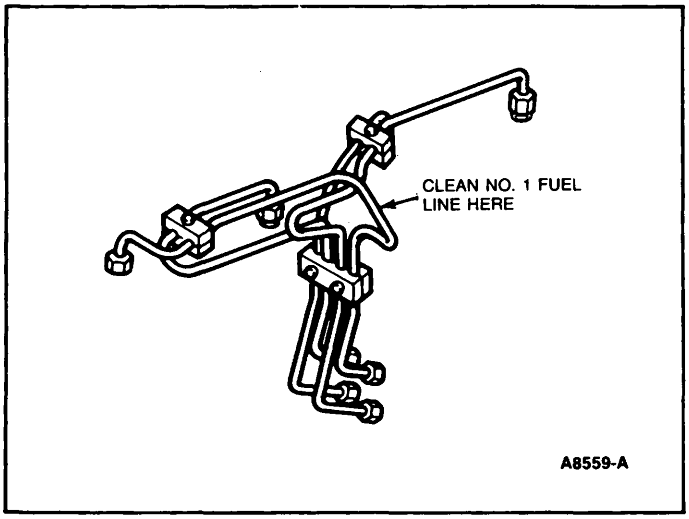


Figure 17 Cleaning Location

2. Install pressure transducer (Fig. 18) around No. 1 high pressure fuel line at position indicated (Fig. 17).

NOTE: Be sure entire contact surface of pressure transducer contacts fuel line.

3. Tighten pressure transducer clamp thumbscrew to insure accuracy of meter reading.

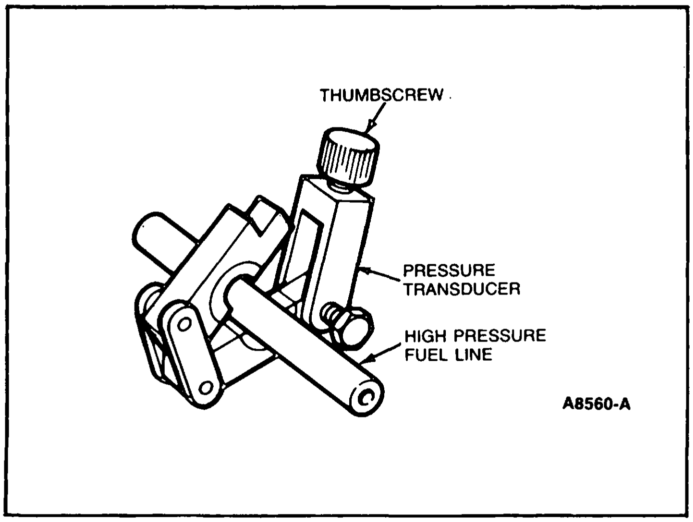


Figure 18 Pressure Transducer Location

Setting Injection Timing — Dynamic

4. Install Injection Pump Rotating Tool Rotunda 014-00413, or equivalent, on top of injection pump altitude compensator (Fig. 19).

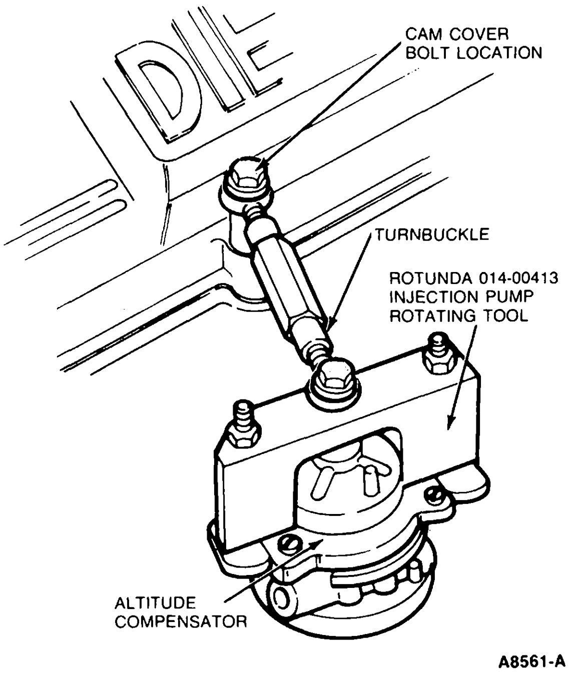


Figure 19 Rotunda 014-00413 Injection Pump Rotating Tool Installation

Setting Injection Timing — Dynamic

5. Remove No. 3 front cam cover bolt and install turnbuckle bolt in its place (Fig. 19).
6. Remove plastic cover from flywheel access hole in transaxle housing. Install electromagnetic pickup adapter in access hole (Fig. 20).

NOTE: The adapter has captive thumb screws for installation.

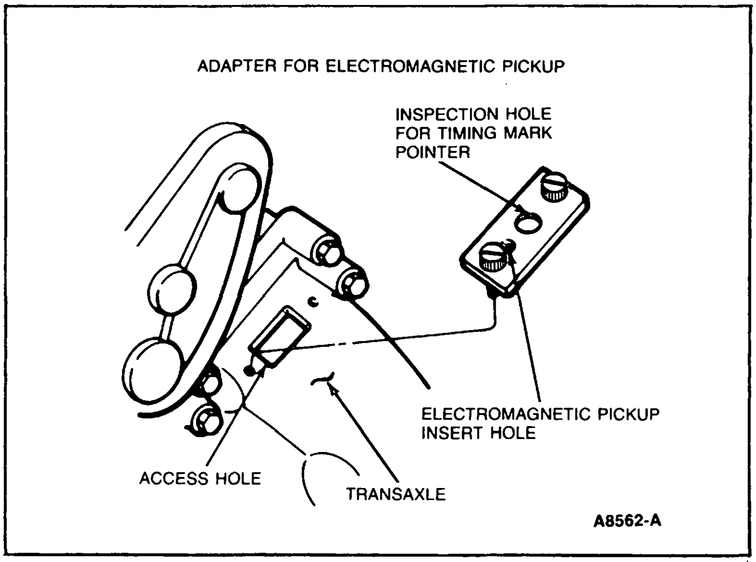

ADAPTER FOR ELECTROMAGNETIC PICKUP
INSPECTION HOLE FOR TIMING MARK POINTER
ELECTROMAGNETIC PICKUP INSERT HOLE
ACCESS HOLE
TRANSAXLE
A8562-A

Figure 20 Electromagnetic Pickup Adapter

NOTE: Be sure locating notch on adapter engages tip of flywheel timing mark pointer (Fig. 21).

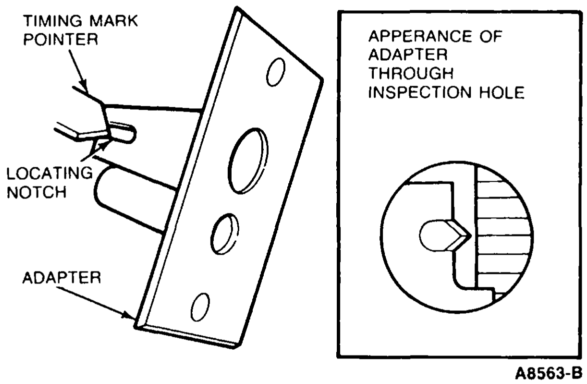


Figure 21 Timing Mark Pointer

Setting Injection Timing — Dynamic

7. Connect Rotunda 078-00100 Dynamic Timing Meter and 2.0L Timing Adapter Kit 078-00124 or equivalents to the engine as follows:
   - Insert electromagnetic pickup into adapter (Fig. 22).

   NOTE: If the pickup is farther than 1mm (0.04 inch) from the flywheel, the meter will not read accurately.

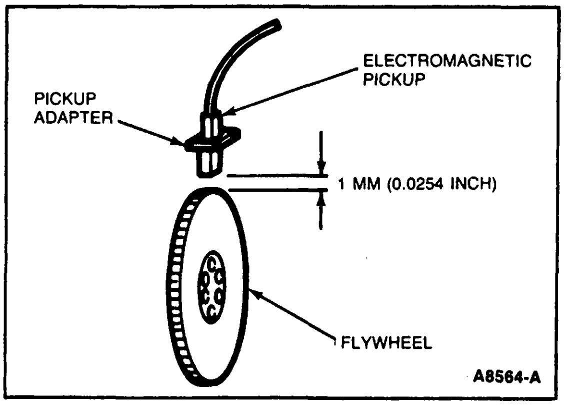


Figure 22 Electromagnetic Pickup Installation

   - Connect signal cable to ground and to pressure transducer (Fig. 23).

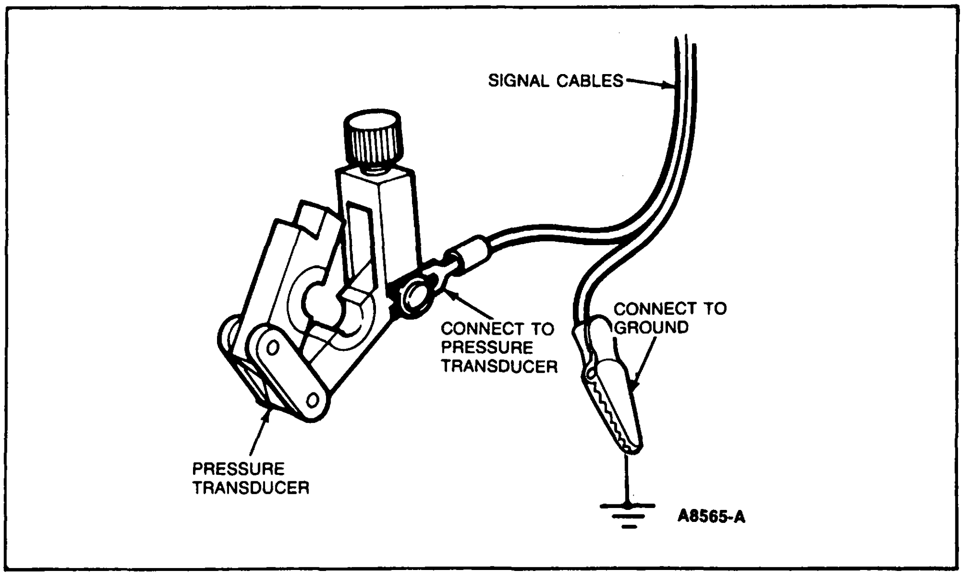


Figure 23 Signal Cable Connections

Setting Injection Timing — Dynamic

- Connect timing meter battery cables to battery.

8. Set timing meter offset angle to −20 degrees. RPM meter should indicate 0000 (Fig. 24).

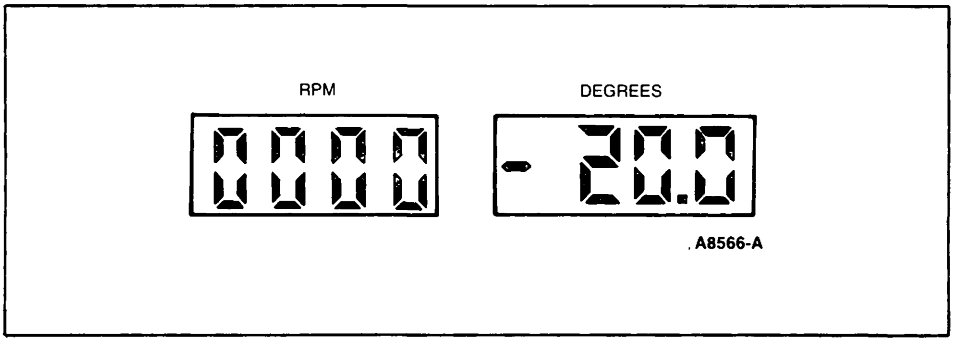


Figure 24 Timing Meter Adjustment Readings

9. Start engine. Install Rotunda 014-00302 Throttle Control, or equivalent, and set engine speed to 2000-2500 rpm, all accessories off, no load. Warm engine up until engine cooling fan turns on.
10. Adjust engine speed to 750 ± 10 rpm with all accessories off. Engine timing on the meter should be 8 ± 1 degrees BTDC.

    NOTE: This dynamic reading of 8 ± 1 degrees BTDC is equivalent to TDC using static measuring method.

11. Disconnect and cap cold start timing advance stage two diaphragm vacuum hose (Fig. 25). Adjust engine speed to 900 ± 100 rpm. Engine timing should be 5 degrees BTDC.
12. Disconnect and cap cold start timing advance stage one diaphragm vacuum hose (Fig. 25). Adjust engine speed to 770 rpm. Engine timing should be 0 degrees BTDC.

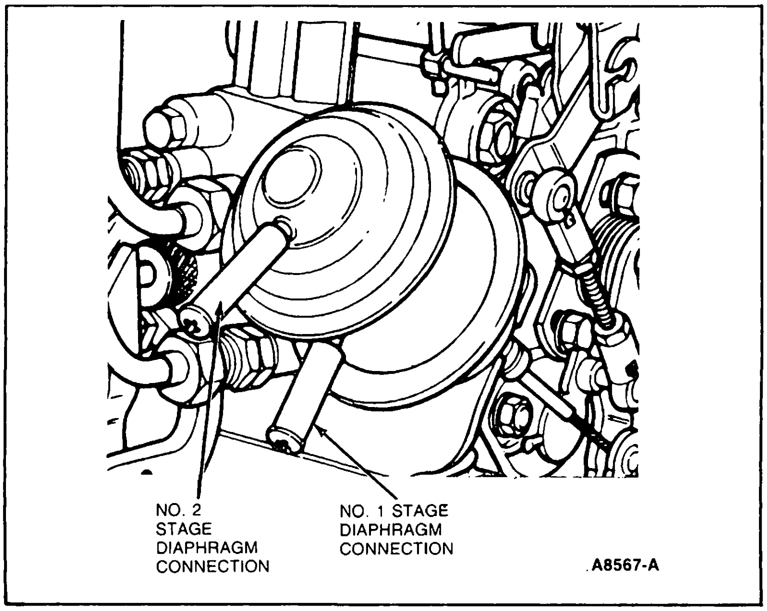

NO. 2 STAGE DIAPHRAGM CONNECTION
NO. 1 STAGE DIAPHRAGM CONNECTION
A8567-A

Figure 25 Cold Start Advance Diaphragm Connections

Setting Injection Timing — Dynamic

13. If indicated timing is within specifications, connect vacuum lines to cold start advance diaphragms, disconnect timing meter, remove injection pump rotating tool and install No. 3 front cam cover bolt.
14. If indicated timing is not within specification, adjust pump timing as follows:
    - Turn engine off.
    - Disconnect battery ground cable.
    - Loosen two injection pump mounting nuts and one bolt one half turn.
    - Connect battery ground cable.
    - Start engine and set idle speed to 750 ± 10 rpm.
    - Rotate turnbuckle counterclockwise to advance timing and clockwise to retard timing (Fig. 26) to obtain timing of 8 ± 1 degrees BTDC.
    - Turn engine off and disconnect battery ground cable.
    - Tighten injection pump mounting nuts to 19-26 N•m (14-19 lb-ft). Tighten mounting bolt to 31-46 N·m (23-34 lb-ft). Connect battery ground cable.
    - Start engine and set idle speed to 750 ± 10 rpm.
    - Check that timing is to specification.

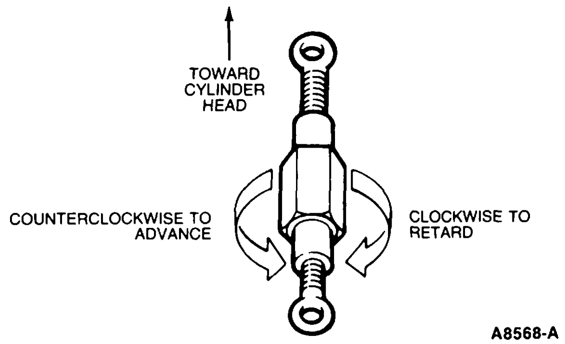


Figure 26 Turnbuckle Rotation

15. With cold start advance diaphragm vacuum hoses still disconnected, repeat steps 10, 11 and 12 to readjust injection timing if necessary.
16. Connect vacuum hoses to cold start advance diaphragms, disconnect timing meter, remove injection pump rotating tool and install plastic flywheel access cover and No. 3 front cam cover bolt.

System Description and Diagnosis

This portion of this Section contains a brief description of the 2.0L diesel engine Quick Start and Afterglow System and Fuel Injection System. It also contains detailed diagnostic procedures for these systems.

The diagnostic procedures are broken into two parts. The first part is Symptom Analysis. This section should be consulted first, as it will direct you to perform a specific service or it will direct you to a specific diagnostic procedure.

The second part contains the Wait-to-Start Lamp, Fast Start Glow Plug System and Engine Performance diagnostic procedures. At the beginning of each of these procedures, there is an explanation of how to use that procedure. Read this explanation before performing the tests.

Quick Start and Afterglow System

This system is used to enable the engine to start more quickly when the engine is cold. It consists of the four glow plugs, the control module, two relays, a glow plug resistor assembly, coolant temperature switch, clutch and neutral switches and connecting wiring. Relay power and feedback circuits are protected by fuse links in the wiring harness. The control module is protected by a separate 10A fuse in the fuse panel.

When the ignition switch is turned to the On position, a Wait-to-Start lamp in the instrument cluster lights. When the lamp lights, relay No. 1 also closes and full system voltage is applied to the glow plugs. If engine coolant temperature is below 30°C (86°F), relay No. 2 also closes at this time. After three seconds, the control module turns off the Wait-to-Start lamp indicating that the engine is ready for starting. If the ignition switch is left in the On position about three seconds more without cranking, the control opens relay No. 1 and current to the plugs stops to prevent overheating. However, if coolant temperature is below 30°C (86°F) when relay No. 1 opens, relay No. 2 remains closed to apply reduced voltage to the plugs through the glow plug resistor until the ignition switch is turned Off (Fig. 27).

CAUTION: LEAVING THE IGNITION SWITCH ON WITHOUT STARTING THE ENGINE WILL RUN DOWN THE BATTERY.

When the engine is cranked, the control module cycles relay No. 1 intermittently. Thus, glow plug voltage will alternate between 12 and 4 volts, during cranking, with relay No. 2 closed, or between 12 and zero volts with relay No. 2 open. After the engine starts, alternator output signals the control module to stop the No. 1 relay cycling and the afterglow function takes over.

If the engine coolant temperature is below 30°C (86°F), the No. 2 relay remains closed. This applies reduced (4.2 to 5.3) voltage to the glow plugs through the glow plug resistor. When the vehicle is under way (clutch and neutral switches closed), or coolant temperature is above 30°C (86°F), the control module opens relay No. 2, cutting off all current to the glow plugs.

Quick Start and Afterglow System

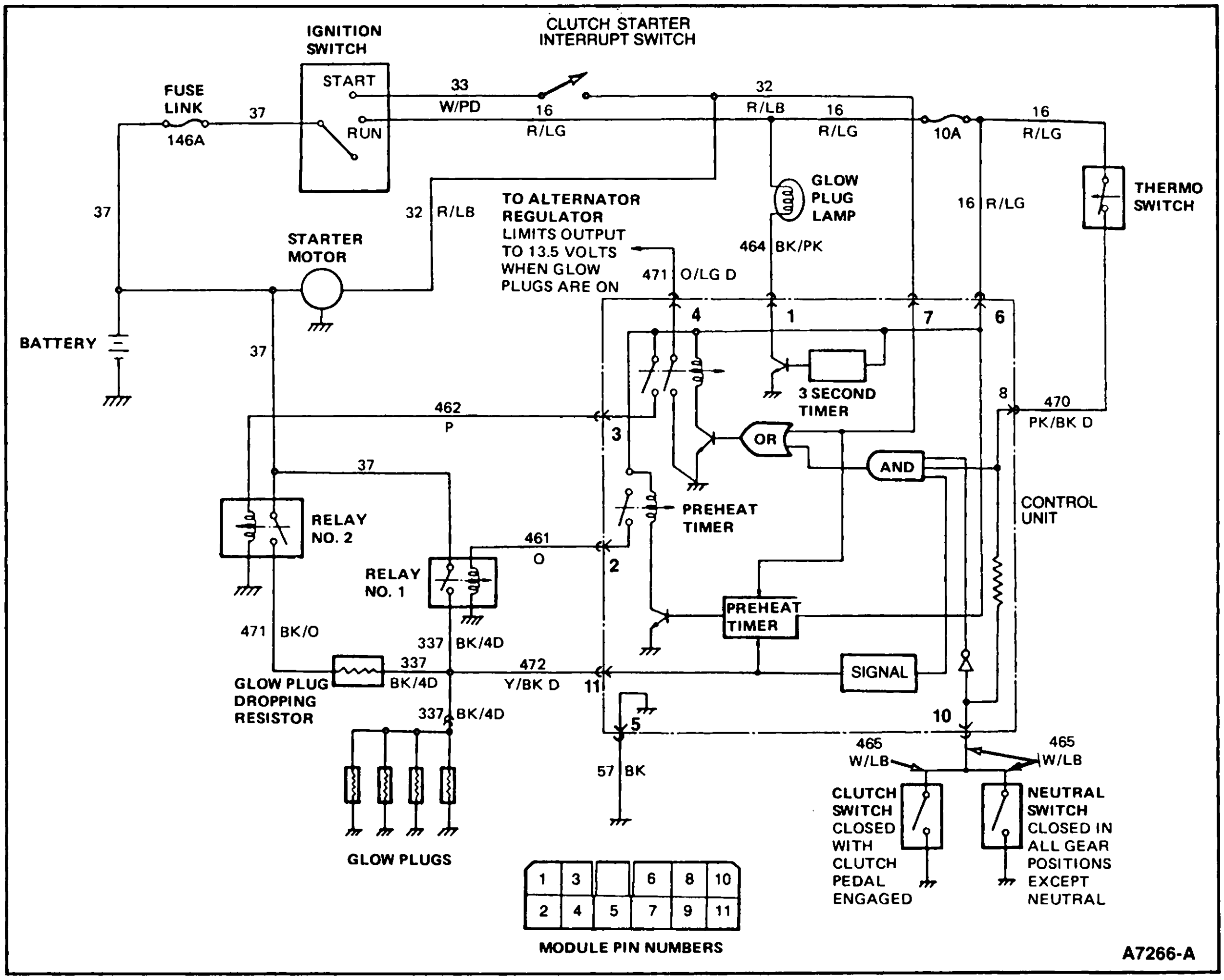


Figure 27 Quick Start Control System Schematic

Fuel System Description

Refer to Fig. 28.

The fuel in the fuel tank is introduced into the fuel lines by the injection pump's integral feed pump. Any water or contaminants in the fuel are extracted by the fuel filter/conditioner before the fuel reaches the injection pump. The fuel supplied to the injection pump is sent into the plunger by the control sleeve, linked with the accelerator, in an amount proportionate to the degree of accelerator depression. The pressure of the fuel in the injection pump will be controlled in accordance with the engine speed by the operation of the feed pump and the regulating valve built into the pump.

The fuel sent to the plunger is highly pressurized and is forced through the delivery valve, into the injection line, then to the injection nozzle. The fuel is then injected into each cylinder in the proper injection order.

Any fuel leaking at the sliding section of the nozzle needle valve at the time of injection, and any surplus fuel in the injection pump housing will be returned to the fuel tank through the return line. The surplus fuel circulates through to injection pump to cool and lubricate the pump.

A fuel cut off solenoid, located on the pump and activated with the ignition switch in the Run or Start position, interrupts the fuel flow on the distributor side of the injection pump when the ignition switch is turned to the Off position. This closes the intake port of the plunger and stops the engine.

A fuel filter/conditioner is located in the fuel line between the fuel tank and the injection pump. This separates any water in the fuel. When the fuel filter/conditioner is full of water, a sensor causes the ENGINE lamp on the instrument panel to flash, warning the driver to drain the water.

The injection nozzle injects the fuel directly into the pre-combustion chamber. When high pressure fuel from the injection pump reaches a certain pressure, 135 kg/cm^2 (1920 psi) or more, the fuel overcomes the needle pressure spring, lifts the needle valve off its seat and allows the fuel to enter the cylinder. When the fuel pressure drops below nozzle opening pressure, the needle valve closes, stopping the fuel injection into the cylinder. During this process some fuel lubricates the nozzle between the needle valve and nozzle body, then returns to the fuel tank through the return line.

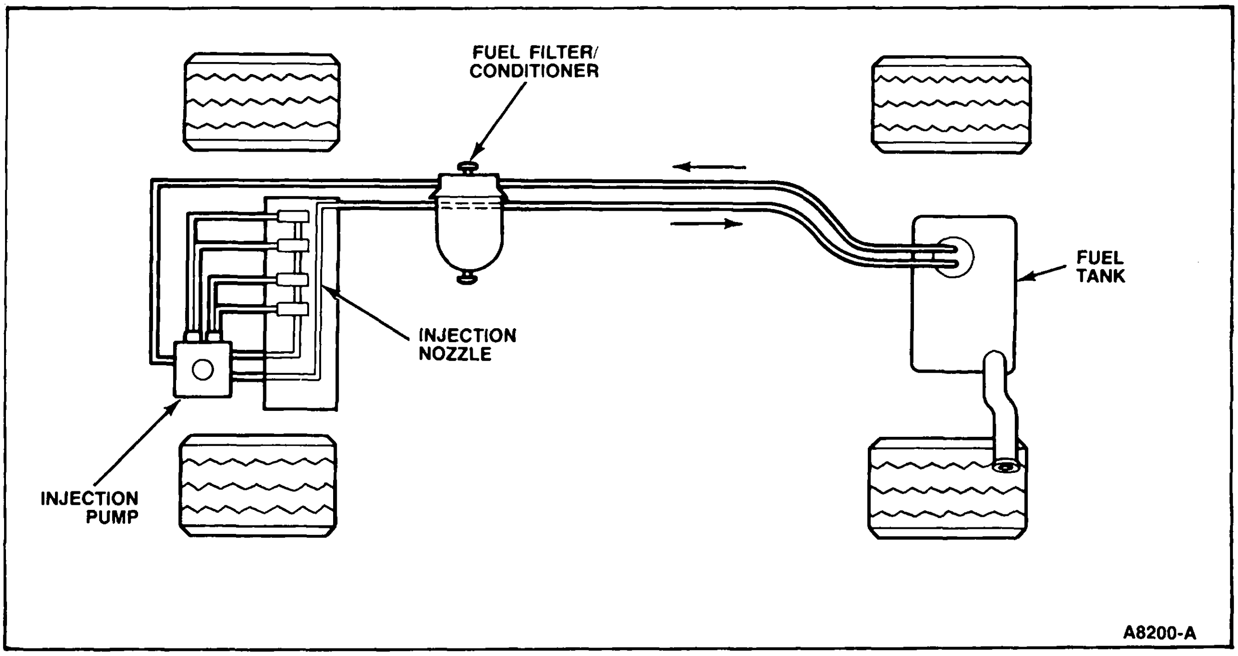


Figure 28 Fuel System

Symptom Analysis

The Symptom Analysis Diagnostic Procedures should be consulted first. These will direct you to a service to be performed or it will direct you to either the Fast Start Glow Plug System Diagnostic Procedure or the Engine Performance Diagnostic Procedure.

If the WAIT-TO-START lamp is suspected of being faulty, go directly to the WAIT-TO-START diagnostic procedure before performing the Glow Plug System Diagnostic Procedure.

If the problem is Loss of Power and/or Increased Fuel Consumption, go directly to the Engine Performance Diagnostic Procedure.

The following is a description of what is normal and expected exhaust smoke. Diesel exhaust smoke can be classified into two categories according to visual appearance. The first category is blue-white smoke.

- Blue-white smoke may be observed at engine start up whether the engine is up to operating temperatures or not. This start up smoke will be observed in warm as well as cold weather and should last no longer than a minute of driving vehicle.
- When ambient temperature is below 10°C (50°F), blue-white smoke can return after the engine warm up period due to extended idling. This is because the combustion chambers cool down during periods of extended idling time.

The second category of diesel exhaust smoke is black smoke. Black smoke occurs whenever the engine is working hard. The engine works hard when it is going up a steep grade, pulling a trailer, carrying a heavy load, or during acceleration while lugging a heavy load. More black smoke will be observed at higher altitudes than at lower altitudes. If black smoke is observed while the engine is idling (at low altitude) or under normal driving conditions, the problem should be diagnosed as soon as possible.

NOTE: After completing service or replacement of a component, it is not necessary to continue the pinpoint test. However, the system operation should be checked to ensure that all problem conditions have been eliminated.

Engine Cranks But Will Not Start

TEST STEP	RESULT ▶	ACTION TO TAKE
A0 STARTING PROCEDURE		
• Check and follow correct starting procedure.	OK ▶	RETURN vehicle to customer.
	~~OK~~ ▶	GO to A1.
A1 CURRENT TO FUEL SHUT OFF SOLENOID		
• Turn ignition switch to Run position. Using a 12-volt test lamp, check to see that voltage is available at solenoid.	OK ▶	GO to A2.
	~~OK~~ ▶	SERVICE or REPLACE circuit as necessary. REPEAT Test Step A1.
A2 FUEL SHUT OFF SOLENOID		
• With ignition switch in Run position, disconnect and connect connector at fuel shut off solenoid.	Solenoid clicks ▶	GO to A3.
	Solenoid does not click ▶	REPLACE fuel shut off solenoid and REPEAT Test Step A2.
A3 FUEL FLOW CHECK		
• Loosen one injector nozzle line nut and crank engine.	Fuel discharges ▶	GO to Glow Plug Control System Diagnosis in this Section.
	Fuel does not discharge ▶	GO to Engine Performance Diagnosis in this Section.

Engine Knocks

TEST STEP	RESULT ▶	ACTION TO TAKE
B0 BELT DRIVEN ACCESSORIES		
• Check belt driven accessories for looseness.	OK ▶	GO to **B1**.
	~~OK~~ ▶	SERVICE or REPLACE as necessary. REFER to Shop Manual, Section 27-02.
B1 FUEL SYSTEM CHECK		
• Perform fuel system diagnostic procedures in this section.	OK ▶	PERFORM engine bearing inspection. Refer to Shop Manual, Section 22-06.
	~~OK~~ ▶	SERVICE and ADJUST as necessary. If engine still knocks, PERFORM engine bearing inspection. Refer to Shop Manual, Section 22-06.

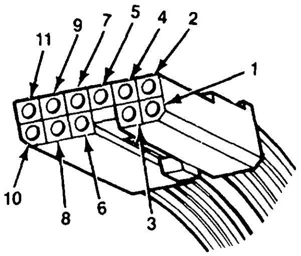
Engine Misses/Runs Rough

TEST STEP	RESULT ▶	ACTION TO TAKE
C0 DETERMINE WHEN MISS OCCURS		
• Engine will miss when cold if one or more glow plugs are not heating.	Engine misses only when cold ▶	REFER to Glow Plug Control System in this Section.
	Engine misses at operating temperature ▶	GO to **C1**.
C1 CHECK EGR OPERATION		
• Disconnect vacuum lines from both EGR valves.	Engine runs properly ▶	REFER to Excessive Smoke/Poor Performance in this Section.
	Engine runs rough ▶	GO to **C2**.
C2 CHECK EGR VALVES		
• Disconnect EGR supply tube from valve assembly and exhaust manifold. • Plug exhaust manifold port. • Start engine.	Engine runs properly ▶	SERVICE EGR valves as necessary.
	Engine runs rough ▶	REFER to Engine Performance Diagnosis in this Section.

Excessive Smoke/Poor Performance

TEST STEP	RESULT ▶	ACTION TO TAKE
D0 DETERMINE WHEN EXCESSIVE SMOKE OCCURS		
○ Engine will smoke when cold if one or more glow plugs are not heating.	Engine smokes only when cold ▶	REFER to Glow Plug Control System in this Section.
	Engine smokes at operating temperatures ▶	GO to D1.
D1 CHECK EGR VACUUM		
○ Attach two vacuum gauges, Rotunda 054-00008 or equivalent, in-line at EGR valve vacuum hoses. ○ Start engine and allow engine to idle. ○ Observe vacuum gauges.	Vacuum at one or both gauges ▶	LEAVE engine running. GO to D2.
	Zero vacuum at both gauges ▶	REFER to EGR System Performance Diagnosis in this Section.
D2 CHECK EGR SOLENOIDS		
○ Disconnect electrical connectors at EGR solenoids. ○ Observe vacuum gauges.	Vacuum at gauges ▶	REPLACE solenoid valves. CHECK system operation.
	No vacuum at gauges ▶	GO to D3.
D3 CHECK WIRING HARNESS		
○ Check circuits to solenoid valves for open circuits or shorts to ground.	OK ▶	REFER to EGR System Performance Diagnosis in this Section.
	~~OK~~ ▶	SERVICE open circuits or shorts as necessary. CHECK system operation.

Wait-To-Start Lamp (Refer to Quick Start Control System Schematic)

TEST STEP	RESULT ▶	ACTION TO TAKE
E0 WAIT LAMP		
• Turn ignition to RUN. Wait lamp should stay on for 3 seconds, then go out.	OK ▶	GO to Glow Plug Control System in this Section.
	Lamp does not light ▶	GO to E1.
	Lamp lights, but does not go out ▶	REPLACE glow plug control module and REPEAT test Step E0.
E1 WAIT LAMP BULB		
• Connect a jumper wire between glow plug control module connector terminal No. 1 and ground. **NOTE: Located under LH side of instrument panel.** • Turn ignition to RUN. 	Wait lamp lights ▶	GO to E2.
	Wait lamp does not light ▶	REPLACE wait lamp bulb or SERVICE or REPLACE wait lamp wiring as necessary. REPEAT Test Step E0.
E2 TERMINAL 6 (POWER CIRCUIT)		
• Connect a 12V test lamp to connector terminal No. 6 and ground. • Turn ignition to RUN.	Test lamp lights ▶	REPLACE glow plug control module. REPEAT Test Step E0.
	Test lamp does not light ▶	SERVICE and/or REPLACE ignition switch and/or wiring as necessary. REPEAT Test Step E0.

Glow Plug Control System (Refer to Quick Start Control System Schematic)

TEST STEP	RESULT ▶	ACTION TO TAKE
F0 CHECK VOLTAGE TO EACH GLOW PLUG		
• Place transmission gear selector in NEUTRAL. **NOTE: If engine coolant temperature is above 30°C (86°F), jumper connections at coolant thermoswitch.** • Turn ignition switch to RUN. • Using a voltmeter, Rotunda 007-00001 or equivalent, check voltage at each glow plug lead. Minimum of 11 volts at each lead for 6 seconds, then drops to 4.2 to 5.3 volts.	Voltage OK ▶	REMOVE jumper from coolant thermoswitch. GO to F13.
	No voltage ▶	GO to F1.
	No voltage at 3 or less glow plugs ▶	REPLACE glow plug harness. REPEAT Test Step F0.
	Voltage is OK for 6 seconds, then drops to zero ▶	GO to F6.
	Voltage is OK for 6 seconds, then remains at a minimum of 11V ▶	REPLACE glow plug control module.
F1 ENGINE HARNESS TO GLOW PLUG HARNESS		
• Disconnect glow plug harness from engine harness and glow plugs. • Connect a self-powered test lamp between glow plug harness connector and each glow plug terminal.	Test lamp lights ▶	RECONNECT glow plug harness. GO to F2.
	Test lamp does not light ▶	SERVICE or REPLACE glow plug harness. REPEAT Test Step F0.
F2 TERMINAL 6 (POWER CIRCUIT)		
• Connect a 12 volt test lamp between glow plug control module terminal No. 6 and ground. • Turn ignition switch to RUN.	Test lamp lights ▶	GO to F3.
	Test lamp does not light ▶	SERVICE and/or REPLACE ignition switch and/or wiring as necessary. REPEAT Test Step F0.

Glow Plug Control System

TEST STEP		RESULT ▶	ACTION TO TAKE
F3	TERMINAL 2 (NO. 1 GLOW PLUG RELAY SIGNAL)		
	• Connect a 12 volt test lamp between glow plug control module terminal No. 2 (signal) and ground. • Turn ignition switch to RUN.	Test lamp lights for 6 seconds ▶	GO to F4.
		Test lamp does not light ▶	REPLACE quick start control unit. REPEAT Test Step F3.
F4	NO. 1 GLOW PLUG RELAY WIRING		
	• Connect a 12 volt test lamp between No. 1 glow plug relay signal terminal and ground. • Turn ignition to RUN.	Test lamp lights for 6 seconds ▶	GO to F5.
		Test lamp does not light ▶	SERVICE or REPLACE wiring between quick start control unit terminal 2 and No. 1 glow plug relay. REPEAT Test Step F4.
F5	NO. 1 GLOW PLUG RELAY		
	• Connect a voltmeter between No. 1 glow plug relay output terminal (to glow plugs) and ground. • Turn ignition switch to RUN.	11 volts or more for 6 seconds ▶	GO to F12.
		Less than 11 volts ▶	REPLACE No. 1 glow plug relay. REPEAT Test Step F5.
F6	TERMINAL NO. 3 (NO. 2 GLOW PLUG RELAY SIGNAL)		
	• Connect a 12 volt test lamp between glow plug control module terminal No. 3 (signal) and ground. • Turn ignition switch to RUN.	Test lamp lights ▶	GO to F8.
		Test lamp does not light ▶	GO to F7.

Glow Plug Control System

TEST STEP	RESULT ▶	ACTION TO TAKE
F7 CLUTCH SWITCH/NEUTRAL SWITCH		
• Using a self-powered test lamp, check the functioning of clutch and neutral switch in both open and closed positions. • With transmission in gear and clutch pedal released, both switches should be open. • With transmission in Neutral and clutch pedal depressed, both switches should be closed.	OK ▶	GO to F8.
	~~OK~~ ▶	REPLACE malfunctioning clutch or neutral switch. REPEAT Test Step F7.
F8 NO. 2 GLOW PLUG RELAY WIRING		
• Connect a 12 volt test lamp between No. 2 glow plug relay signal terminal and ground. • Place transmission gear selector in Neutral. • Turn ignition switch to RUN.	Test lamp lights ▶	GO to F9.
	Test lamp does not light ▶	SERVICE or REPLACE wiring between glow plug control module terminal No. 3 and No. 2 glow plug relay. REPEAT Test Step F8.
F9 NO. 2 GLOW PLUG RELAY		
• Connect a 12 volt test lamp between No. 2 glow plug relay output terminal (to glow plugs) and ground. • Turn ignition to RUN.	Test lamp lights ▶	GO to F10.
	Test lamp does not light ▶	REPLACE No. 2 glow plug relay. REPEAT Test Step F9.
F10 DROPPING RESISTOR WIRING		
• Disconnect dropping resistor from wiring harness. • Connect a 12 volt test lamp between the dropping resistor input terminal on wiring harness and ground. • Turn ignition to RUN.	Test lamp lights ▶	GO to F11.
	Test lamp does not light ▶	SERVICE or REPLACE wiring between No. 2 glow plug relay and dropping resistor. REPEAT Test Step F10.

Glow Plug Control System

TEST STEP	RESULT ▶	ACTION TO TAKE
F11 DROPPING RESISTOR		
• Connect an ohmmeter, Rotunda 007-00001 or equivalent, to the connector terminals on the resistor. • Set multiply by knob to X1. • Ohmmeter should indicate less than 1 ohm.	OK ▶	RECONNECT dropping resistor to wiring harness. GO to **F12**.
	~~OK~~ ▶	REPLACE dropping resistor. REPEAT Test Step **F11**.
F12 GLOW PLUG HARNESS		
• Connect a 12 volt test lamp between any glow plug terminal and ground. • Turn ignition to RUN.	Test lamp lights ▶	GO to **F0**.
	Test lamp does not light ▶	SERVICE or REPLACE wiring from No. 1 glow plug relay to glow plug harness. REPEAT Test Step **F12**.
F13 GLOW PLUGS		
• Disconnect leads from each glow plug. • Connect one lead of ohmmeter to glow plug terminal and one lead to a good ground. • Set ohmmeter multiply by knob to X1. • Test each glow plug.	Meter indicates less than one ohm ▶	Problem is not in glow plug system. REFER to Engine Performance Diagnosis in this Section.
	Meter indicates one ohm or more ▶	REPLACE glow plug. REPEAT Test Step **F13**.

Cold Start Device (CSD) Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
G0 CHECK COLD IDLE RPM ○ Remove timing mark cover on transmission housing. Clean flywheel and install reflective tape. ○ Warm up engine to operating temperature. ○ Rotate CSD lever clockwise to stopper. ○ Engine RPM should be 1450-1550 rpm.	OK ▶	CSD OK. REFER to Engine Performance Diagnosis in this Section.
	~~OK~~ ▶	GO to **G1**.
G1 CHECK INITIAL INJECTION TIMING ○ Check injection pump timing as described in this Section.	OK ▶	LEAVE dial indicator installed. GO to **G2**.
	~~OK~~ ▶	ADJUST as necessary. GO to **G0**.
G2 CHECK CSD ADVANCE INJECTION TIMING ○ Rotate crankshaft counterclockwise to 30-50 degrees BTDC, until indicator returns to zero. ○ Apply 500mm Hg (20 in-Hg) to the CSD vacuum diaphragms. ○ Rotate the crankshaft clockwise to 8 degrees BTDC. ○ Dial indicator should read 1mm (0.039 inch).	OK ▶	REMOVE dial indicator. GO to **G3**.
	~~OK~~ ▶	LOOSEN CSD stopper screws. ADJUST stopper until dial indicator reads 1mm (0.039 inch). REMOVE dial indicator. GO to **G0**.
G3 CHECK CSD DIAPHRAGMS ○ Apply 138 kPa (20 in-Hg) to CSD diaphragm. ○ Measure distance CSD lever moves. ○ Lever should move 28mm (1.10 inches).	OK ▶	GO to **G4**.
	~~OK~~ ▶	REPLACE injection pump. REFER to Shop Manual Section 22-06.

Cold Start Device (CSD) Diagnosis

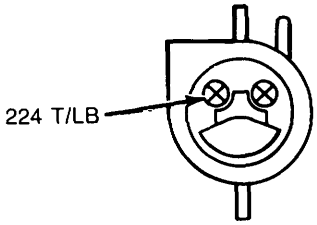
TEST STEP	RESULT ▶	ACTION TO TAKE
G4 CHECK WATER THERMO VALVE		
• Remove thermo valve from thermostat housing. • Check the calibration of the valve with 138 kPa (20 in-Hg) applied as follows:	OK ▶	REFER to Vacuum Pump Diagnosis in this Section.
	~~OK~~ ▶	REPLACE water thermo valve. GO to G0.

Temperature	1st Stage	2nd Stage
Below 7 ± 5°C (45 ± 41°F)	Open	Open
7 ± 5°C – 20 ± 3°C (45 ± 41°F – 68 ± 37°F)	Open	Closed
Over 20 ± 3°C (68 ± 37°F)	Closed	Closed

Vacuum Pump Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
H0 CHECK PUMP OPERATION		
• Turn ignition switch to Run position. • Pump should run.	OK ▶	GO to **H3**.
	~~OK~~ ▶	GO to **H1**.
H1 CHECK FOR VOLTAGE		
• Remove connector at vacuum pump and check for voltage on circuit 687 GY/B.	OK ▶	GO to **H2**.
	~~OK~~ ▶	SERVICE circuit 687 GY/B and/or fuse link for open. GO to **H0**.
H2 CHECK GROUND		
• Check circuit 57 BK for continuity between connector and ground.	OK ▶	REPLACE vacuum pump.
	~~OK~~ ▶	SERVICE circuit 57 BK for open. GO to **H0**.
H3 CHECK VACUUM		
• Attach vacuum gauge to vacuum pump port with a tee fitting. • Turn ignition switch to Run. • Vacuum should increase to 165 ± 7 kPa (24 ± 1 in. Hg). Pump should turn Off. • Observe vacuum gauge while an assistant pumps brake pedal several times. • Vacuum pump should turn On when vacuum drops below 131 ± 7 kPa (19 + 1 in. Hg).	OK ▶	Vacuum pump OK. Problem is elsewhere in vacuum system. SERVICE vacuum lines or components as necessary.
	~~OK~~ ▶	REPLACE vacuum pump. REFER to Shop Manual, Section 22-06.

EGR System Performance Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
J0 CHECK EGR SYSTEM OPERATION		
NOTE: Perform these tests only if directed here from another test. Disconnect glow plug control module to prevent battery drain. Connect glow plug module after tests. • Disconnect vacuum hoses at EGR valves. • Start engine and run at idle. • Apply 50 kPa (15 in.-Hg.) to each valve, one at a time.	Idle changed for both valves ▶ Idle did not change for one or both valves ▶	GO to J1. SERVICE or REPLACE valve(s) or supply hoses as necessary. GO to J1.
J1 EGR SYSTEM DYNAMIC TEST		
• Turn engine off. • Disconnect top gear switch on transmission shift linkage. • Jumper between Circuit 224 (T/LB) and ground.  • Connect two vacuum gauges, Rotunda 059-00008 or equivalent, in-line at EGR valves. • Start engine. • Bring engine up to operating temperature (upper radiator hose hot). • Raise engine rpm to 1050 ± 50. Both gauges should show vacuum. • Raise engine rpm to 2700 ± 100. Neither gauge should show vacuum.	OK ▶ ~~OK~~ ▶	TURN engine off. GO to J2. REFER to EGR Vacuum System Diagnosis in this Section.

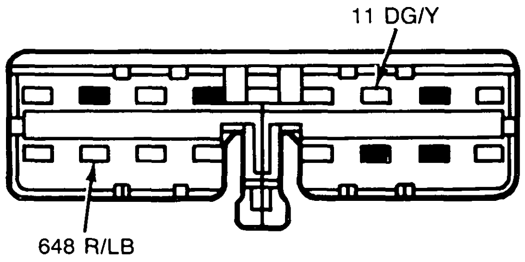
EGR System Performance Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
J2 CHECK TOP GEAR SWITCH		
○ Connect top gear switch connector. ○ Remove EGR control module (behind LH side of I/P). Leave connector connected. ○ Turn ignition to RUN. ○ From back of connector, measure voltage at Circuit 224 (T/LB). ○ Should read zero volts with transmission in NEUTRAL. ○ Should read 4.5-5.0V with transmission in 5th gear.	OK ▶	GO to J3.
	Voltage high ~~OK~~ ▶	GO to EGR Module Diagnosis Pinpoint Test Step K3.
	Voltage low ~~OK~~ ▶	GO to EGR Module Diagnosis Pinpoint Test Step K4.
J3 CHECK EGR THERMAL VALVE		
○ Remove thermal valve from engine. ○ Place valve in cold water. ○ Apply vacuum to top port of valve.	Vacuum holds ▶	EGR system OK. REFER to Engine Performance Diagnosis in this Section.
	Vacuum does not hold ▶	REPLACE thermal valve. CHECK system operation.

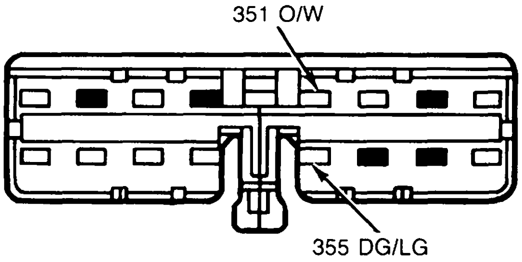
EGR Module Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
K0 CHECK BATTERY VOLTAGE		
NOTE: Perform these tests only if directed here from another test. Disconnect glow plug control module to prevent battery drain. Connect glow plug module after tests. • Remove EGR control module (behind LH side of I/P). Leave connector connected. • Turn ignition to RUN. • From back of connector, measure voltage at Circuit 16 (R/LG). • Should read 11.5V or more.	OK ▶	GO to K1.
	~~OK~~ ▶	SERVICE open in circuit between module and ignition switch. GO to K1.
K1 CHECK EGR SYSTEM PERFORMANCE		
• Perform EGR System Performance Diagnosis in this Section.	Pass ▶	EGR system OK. INSTALL module. CONNECT all connectors. RELEASE vehicle.
	Fail ▶	GO to K2.
K2 CHECK TOP GEAR SWITCH		
• Turn ignition to RUN. • From back of EGR module connector, measure voltage at Circuit 224 (T/LB). • Should read zero volts with transmission in NEUTRAL. • Should read 4.5-5.0 volts with transmission in 5th gear.	OK ▶	GO to K5.
	Voltage high ~~OK~~ ▶	GO to K3.
	Voltage low ~~OK~~ ▶	GO to K4.
K3 CHECK HIGH VOLTAGE		
• Disconnect top gear switch on transmission shift linkage. • Jumper between Circuit 224 (T/LB) at top gear switch and ground. • Observe voltmeter.	Voltage low ▶	REPLACE top gear switch.
	Voltage high ▶	SERVICE open in Circuit 224 (T/LB).

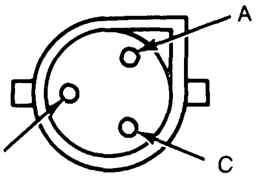
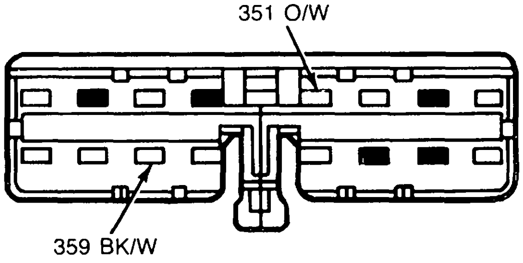
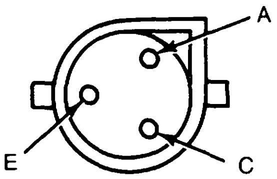
EGR Module Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
K4 CHECK LOW VOLTAGE		
○ Disconnect top gear switch on transmission shift linkage. ○ Observe voltmeter.	Voltage low ▶	SERVICE short to ground in Circuit 224 (T/LB).
	Voltage high ▶	REPLACE top gear switch.
K5 CHECK INJECTION PUMP SPEED SENSOR		
○ Start engine. ○ Check tachometer operation.	OK ▶	GO to **K8**.
	~~OK~~ ▶	GO to **K6**.
K6 CHECK SPEED SENSOR CIRCUIT		
○ Turn ignition to OFF. ○ Disconnect EGR control module connector. ○ Check continuity between Circuit 11 (DG/Y) and Circuit 648 (R/LB).	Continuity ▶	REPLACE module. CHECK system operation.
	No continuity ▶	GO to **K7**.
K7 CHECK SPEED SENSOR CONTINUITY		
○ Disconnect speed sensor at injection pump. ○ Check continuity of speed sensor.	Continuity ▶	SERVICE open in circuits between module and speed sensor.
	No continuity ▶	REPLACE speed sensor.

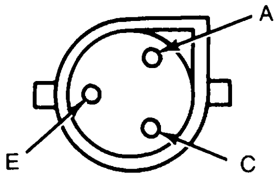
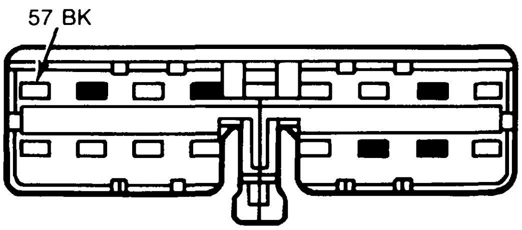
EGR Module Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
K8 CHECK THROTTLE POSITION SENSOR		
• Turn ignition to RUN. • From back of EGR module connector, measure voltage at Circuit 351 (O/W).	Less than 4.5V ▶	GO to **K9**.
	4.5V or more ▶	GO to **K11**.
K9 CHECK THROTTLE POSITION SENSOR HARNESS		
• Disconnect throttle position sensor at injection pump. • Observe voltmeter.	Less than 4.5V ▶	LEAVE sensor disconnected. GO to **K10**.
	4.5V or more ▶	REPLACE Throttle Position Sensor.
K10 CHECK MODULE REFERENCE VOLTAGE		
• Check Circuit 351 (O/W) for short to ground. • There should be no short.	OK ▶	REPLACE EGR Control Module.
	~~OK~~ ▶	SERVICE short to ground in Circuit 351 (O/W).
K11 CHECK SENSOR HARNESS RESISTANCE		
• Turn ignition to OFF. • Disconnect EGR module connector. • Set ohmmeter to 1K scale. • Measure resistance between Circuits 351 (O/W) and 355 (DG/LG). • Resistance should be 4K-6K ohms. 	OK ▶	GO to **K13**.
	~~OK~~ ▶	GO to **K12**.

EGR Module Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
K12 CHECK SENSOR RESISTANCE • Disconnect throttle position sensor at injection pump. • Measure resistance of sensor between terminals C and E. • Resistance should be 4K to 6K ohms. 	OK ▶ ~~OK~~ ▶	SERVICE open in circuits between module and sensor. REPLACE Throttle Position Sensor.
K13 CHECK SENSOR HARNESS RESISTANCE • Measure resistance between Circuit 351 (O/W) and Circuit 359 (BK/W) with throttle lever at idle stop. • Resistance should be less than 2K ohms. 	OK ▶ ~~OK~~ ▶	GO to **K15**. GO to **K14**.
K14 CHECK SENSOR RESISTANCE • Disconnect throttle position sensor at injection pump. • Measure sensor resistance between terminals A and E with throttle lever at idle stop. • Resistance should be less than 2K ohms. 	OK ▶ ~~OK~~ ▶	SERVICE circuits between module and sensor as necessary. REPLACE Throttle Position Sensor.

EGR Module Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
K15 THROTTLE POSITION SENSOR DYNAMIC TEST		
• Move throttle to WOT position. • Resistance should increase to 3K ohms or more.	OK ▶ ~~OK~~ ▶	GO to **K17**. GO to **K16**.
K16 DYNAMIC TEST AT SENSOR		
• Disconnect throttle position sensor at injection pump. • Connect ohmmeter between terminals A and E. • Move throttle to WOT position. • Resistance should increase to 3K ohms or more. 	OK ▶ ~~OK~~ ▶	SERVICE open in circuits between module and sensor. REPLACE sensor.
K17 CHECK MODULE GROUND		
• Set ohmmeter to 1X scale. • Measure resistance between Circuit 57 (BK) and ground. • Resistance should be less 0.5 ohms. 	OK ▶ ~~OK~~ ▶	GO to **K18**. SERVICE Circuit 57 BK as necessary.

EGR Module Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
K18 CHECK EGR SOLENOID "A" VOLTAGE		
o Connect EGR module connector. o Turn ignition to RUN. o From back of connector, measure voltage at Circuit 352 (BR/LG). o Should read 11.5V or more.	OK ▶	LEAVE ignition in RUN. GO to **K21**.
	~~OK~~ ▶	GO to **K19**.
K19 CHECK EGR SOLENOID "A" VOLTAGE (Continued)		
o From back of connector, measure voltage at Circuit 352 (BR/LG) at solenoid "A". o Should read 11.5V or more.	OK ▶	SERVICE open in circuit between module and solenoid.
	~~OK~~ ▶	GO to **K20**.
K20 CHECK IGNITION CIRCUIT		
o From back of connector, measure voltage at Circuit 16 (R/LG) at solenoid "A". o Should read 11.5V or more.	OK ▶	REPLACE solenoid "A".
	~~OK~~ ▶	SERVICE open in Circuit 16 (R/LG) between ignition switch and solenoid "A".
K21 CHECK EGR SOLENOID "B" VOLTAGE		
o From back of EGR module connector, measure voltage at Circuit 744 (T/W). o Should read 11.5V or more.	OK ▶	REPLACE EGR module. GO to EGR System Performance Diagnosis.
	~~OK~~ ▶	LEAVE ignition in RUN. GO to **K22**.

EGR Module Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
K22 CHECK EGR SOLENOID “B” VOLTAGE (Continued)		
• From back of connector, measure voltage at Circuit 744 (T/W) at solenoid “B”. • Should read 11.5V or more.	OK ▶	SERVICE open in circuit between module and solenoid.
	~~OK~~ ▶	GO to K23.
K23 CHECK IGNITION CIRCUIT		
• From back of connector, measure voltage at Circuit 16 (R/LG) at solenoid “B”. • Should read 11.5V or more.	OK ▶	REPLACE solenoid “B”.
	~~OK~~ ▶	SERVICE open in Circuit 16 (R/LG) between ignition switch and solenoid “B”.

EGR Vacuum System Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
L0 CHECK EGR SUPPLY VACUUM		
NOTE: Perform this test only if directed here by the EGR System Performance Diagnosis test. o With engine at operating temperature, disconnect vacuum hoses at EGR solenoid valves. o Connect vacuum gauge to hoses and measure vacuum.	Less than 34 kPa (10 in.-Hg.) ▶ 34 kPa (10 in.-Hg.) or more ▶	GO to L2. GO to L1.
L1 CHECK EGR SOLENOIDS		
o Disconnect solenoid connectors. o Apply vacuum to one solenoid. o Jumper one terminal of solenoid to battery positive. o Observe vacuum gauge while jumpering other terminal to ground. o Repeat for other solenoid.	Vacuum releases ▶ Vacuum holds ▶	GO to EGR Module Diagnosis in this Section. REPLACE solenoid valve(s) as necessary. CHECK system operation.
L2 CHECK THERMAL VALVE SUPPLY VACUUM		
o Disconnect vacuum supply hose at thermal valve. o Connect vacuum gauge and start engine. o Observe vacuum gauge.	34 kPa (10 in.-Hg.) or more ▶ Less than 34 kPa (10 in.-Hg.) ▶	GO to L3. REFER to Vacuum Pump Diagnosis in this Section.
L3 CHECK THERMAL VALVE OPERATION		
o Is thermal valve mounting boss hot to the touch (above 63°C [145°F])?	Yes ▶ No ▶	REPLACE thermal valve. CHECK system operation. CHECK cooling system operation. REFER to Powertrain Manual, Volume E, Group 27.

Gauge Bar Setup — Fuel System and Engine Pressure Tests

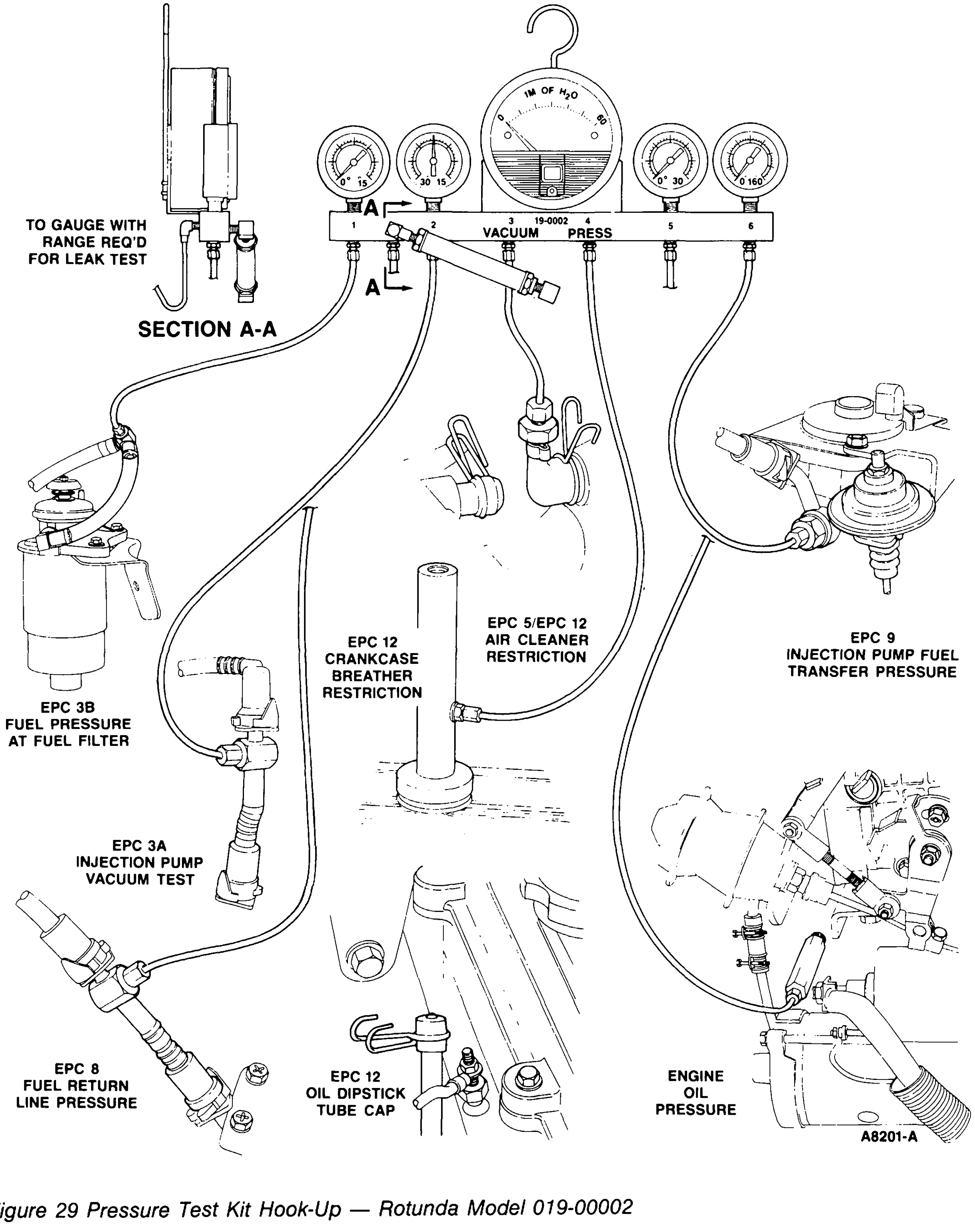


Figure 29 Pressure Test Kit Hook-Up — Rotunda Model 019-00002

Engine Performance Diagnosis

TEST STEP		RESULT ▶	ACTION TO TAKE
EPC.1	CHECK FOR EXTERNAL LEAKAGE		
	• With engine running, visually check for leakage of: 1. Fuel 2. Engine oil 3. Proper installation of air intake system 4. Coolant	OK ▶	GO to **EPC.2**.
		~~OK~~ ▶	SERVICE or REPLACE faulty components as necessary. If running problem still exists, GO to **EPC.2**.
EPC.2	CHECK EXHAUST SYSTEM		
	• Visually inspect exhaust system for dents or kinks which could cause restriction.	OK ▶	GO to **EPC.3A**.
		~~OK~~ ▶	SERVICE or REPLACE exhaust system components as necessary. REFER to Shop Manual, Section 26-09. GO to **EPC.3A**.
EPC.3A	CHECK INJECTION PUMP INLET RESTRICTION		
	• Connect Pressure Test Kit 014-00702, or equivalent (Figure 29). • Disconnect fuel inlet at injection pump. • Install adapter tee 10575 on pump. • Reconnect fuel line to tee. Connect tee to 0-30 in-Hg gauge. • Run engine at 4000 rpm, no load. • Vacuum should be less than 20.6 kPa (3 in. Hg).	OK ▶	GO to **EPC.3B**.
		~~OK~~ ▶	SERVICE or REPLACE chassis fuel lines.
EPC.3B	CHECK FUEL FILTER PRESSURE DROP		
	• Disconnect fuel inlet at fuel filter/conditioner. • Install adapters 5632 and 10329 at fuel filter inlet and reconnect fuel line. Connect adapter line to 0-30 in-Hg gauge. • Run engine at 4000 rpm. • Pressure should be a maximum of 6 in-Hg.	OK ▶	GO to **EPC.4A**.
		~~OK~~ ▶	GO to **EPC.3C**.

Engine Performance Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.3C CHECK FUEL SUPPLY LINE		
• Disconnect fuel supply hose from injection pump and fuel tank. • Plug tank end of hose and pressurize fuel line (maximum of 15 psi) using Adapter and Pressure Test Kit 014-00702, or equivalent. • Apply solution of soapy water to all fuel line hose connections.	No bubbles present ▶	SERVICE tank end of fuel line(s) and/or CHECK fuel sender unit(s) for leaks. REPEAT Test Step **EPC.3B**.
	Bubbles present ▶	SERVICE or REPLACE fuel system components as necessary. (Refer to Shop Manual, Section 25-50). REPEAT Test Step **EPC.3B**.
EPC.4A CHECK FUEL FOR CONTAMINATION		
• In a clear container, take a fuel sample. • Visually examine fuel sample taken, including bottom of container, for particles or liquid contamination, such as water.	OK ▶	GO to **EPC.4B**.
	~~OK~~ ▶	REPLACE fuel filter. CLEAN and/or SERVICE fuel system as required. (Refer to Shop Manual, Section 25-50). GO to **EPC.4B**.
EPC.4B CHECK FUEL FOR CETANE VALUE		
• Check cetane value of fuel sample taken in Test Step **EPC.4A** using cetane tester included with Dynamic Timing Meter, 078-00200. • Cetane value should be minimum of 43.	More than 43 ▶	GO to **EPC.5**.
	Less than 43 ▶	INFORM owner to change fuel source. GO to **EPC.5**.

Engine Performance Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.5 CHECK AIR INTAKE RESTRICTION		
o Remove breather hose between intake manifold and camshaft cover. Install adapter 10353 on the breather nipple at the intake manifold. Install cap 10872 on the camshaft cover nipple. o Connect the adapter line to the 0-60 in. H_2O gauge. o Run engine at 4,000 rpm. o Record restriction reading. o Restriction should not exceed 25 inches of H_2O.	Less than 25 inches H_2O ▶	REMOVE adapter. INSTALL breather hose. GO to **EPC.6**.
	25 inches H_2O or more ▶	REPLACE filter element and CHECK intake system for blockage. REPEAT Test Step **EPC.5**.
EPC.6 ACCELERATOR LINKAGE ADJUSTMENT		
o With engine Off, check that throttle lever contacts injection pump stop at full accelerator pedal depression.	OK ▶	GO to **EPC.7**.
	~~OK~~ ▶	ADJUST or SERVICE throttle linkage as necessary. (Refer to Shop Manual, Section 25-60.) GO to **EPC.7**.
EPC.7 CHECK ENGINE IDLE SPEED		
o Check engine idle speed as described under Adjustments in this section. o Bring engine up to normal operating temperature. o Idle speed is measured with transmission in NEUTRAL. o Idle speed is shown on Vehicle Emission Control Information (VECI) decal.	OK ▶	GO to **EPC.8**.
	~~OK~~ ▶	ADJUST as necessary. GO to **EPC.8**.
EPC.8 CHECK FUEL RETURN PRESSURE		
o Remove fuel return line at injection pump. o Install adapter tee 10575 and connect the fuel line to the tee. Connect the adapter line to the 0-30 in-Hg, 0-15 psi gauge. o Run engine at 4,000 rpm, no load, transmission in NEUTRAL. o Record pressure reading. o Maximum pressure should not exceed 2 psi at 4,000 rpm.	OK ▶	GO to **EPC.9**.
	~~OK~~ ▶	SERVICE or REPLACE fuel return line(s) as necessary. (REFER to Shop Manual, Section 25-50.) REPEAT Test Step **EPC.8**.

Engine Performance Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.9 CHECK INJECTION PUMP TRANSFER PRESSURE		
• Remove banjo bolt from fuel return line. • Install adapter 10326 banjo fitting. Connect adapter line to the 0-160 psi gauge. • Run engine at 4,000 rpm, no load, with transmission in NEUTRAL. • Record pressure reading. • Pressure should be between 70 and 110 psi.	OK ▶	GO to **EPC.10**.
	~~OK~~ ▶	REPLACE injection pump. (REFER to Shop Manual, Section 22-06.) If performance problem still exists after installing new pump, CHECK and ADJUST injection pump timing. (REFER to adjustments in this section.) If performance problem still exists after adjusting timing, GO to **EPC.10**.
EPC.10 INJECTION PUMP TIMING		
• Check injection pump timing. (Refer to Injection Pump Timing under Adjustments in this section.) **NOTE: If timing results obtained are not within specification, remove and test the injection nozzle for that cylinder being used for timing only. If this nozzle does not test to specification, install a replacement nozzle and repeat timing check.** **NOTE: Warranty claims for the injection pump will not be accepted unless all tamper resistant seals are intact.**	OK ▶	GO to **EPC.11**.
	~~OK~~ ▶	ADJUST timing. (REFER to Shop Manual, Section 22-06 and Adjustments in this section.) If performance problem still exists after adjusting timing, GO to **EPC.11**.

Engine Performance Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.11 CHECK INJECTION NOZZLES AND INLET LINES		
○ Check injection nozzle inlet lines for kinks or restriction. (Refer to Shop Manual, Section 22-06). ○ Remove injection nozzles. (Refer to Shop Manual, Section 22-06.) ○ Test injection nozzles as described in this section.	Lines and nozzles OK ▶	GO to **EPC.12** .
	Lines and/or nozzles not OK ▶	REPLACE damaged injection nozzle fuel inlet lines. (REFER to Shop Manual, Section 22-06.) CLEAN or REPLACE injection nozzles as described in this section and Shop Manual, Section 22-06. If performance problem still exists, GO to **EPC.12** .
EPC.12 CRANKCASE PRESSURE TEST		
○ Remove breather hose from camshaft cover and plug opening. (Refer to Shop Manual, Section 22-06.) ○ Remove oil filler cap and install adapter 10340. Connect adapter line to the 0-60 in. H_2O gauge. Install cap 10870 on dipstick tube and cap 10872 on breather nipple of the camshaft cover. ○ Run engine at 4,000 rpm no load, with transmission in Neutral. ○ Record pressure reading. ○ Pressure should not exceed 6 inches H_2O at 4,000 rpm.	OK ▶	REPLACE injection pump, and CHECK and ADJUST timing. (REFER to Shop Manual, Section 22-06 and Adjustments in this section.)
	~~OK~~ ▶	Problem is internal to the engine. (REFER to Shop Manual, Section 22-06.)

Injection Nozzle Testing

Where ideal conditions of good combustion, specified engine temperature control, and absolutely clean fuel prevail, nozzles require little attention. Nozzle trouble is usually indicated by one or more of the following symptoms:

- Smoky exhaust (black)
- Loss of power
- Misfiring
- Increased fuel consumption
- Combustion knock
- Engine overheating

When faulty nozzle operation is suspected on an engine that is misfiring or puffing black smoke, a simple test can be made to determine which cylinder(s) is causing the problem.

- Run the engine at the rpm which makes the problem most pronounced.
- Momentarily loosen the high pressure fuel inlet line connection on one nozzle assembly one half to one turn. Then, tighten connection to specification.
- Check each cylinder in the same manner.
- If one nozzle is found where loosening makes no difference in the misfiring, or the puffing black smoke stops, that nozzle should be tested.

After removing the nozzle(s) from the engine, the Injection Nozzle Test should be performed. This test will provide valuable information regarding the condition of the nozzle(s). Clean workbench, washing fluid containers, tools, and hands are all esstential to produce satisfactory results.

NOTE: It is advisable to test the nozzles before cleaning them.

Injection Nozzle Testing

Figure 30 shows the Rotunda Injection Nozzle Tester, Model No. 014-00300, used for this test.

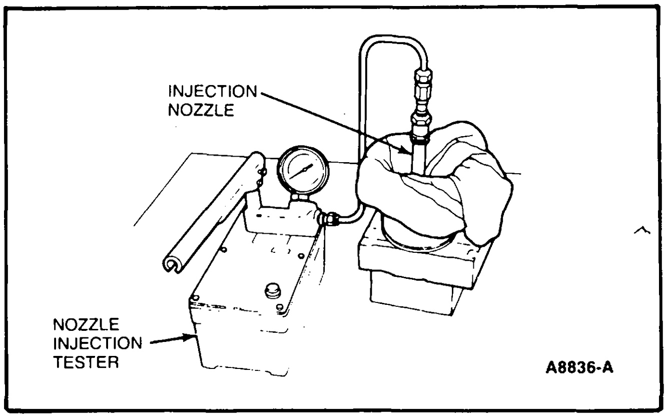


Figure 30 Injection Nozzle Tester

1. Prepare stand for making tests. Fill stand reservoir with clean Calibration Fluid. Open tester valve slightly and operate tester handle to expel air from tester and outlet pipe. Operate tester until solid fluid (without air bubbles) flows from end of outlet pipe. Close tester valve.

2. Connect injection nozzle to test stand. Care should be taken to avoid "cross-threading." Tighten connector nut securely with end wrench. The Nozzle Adapter which is supplied with tester has right hand thread to nozzle assembly and left hand thread to tester piping.

3. Bleed air from nozzle. Open stand valve and operate tester handle for several quick strokes to expel (bleed) air from injection nozzle. Fluid should spray from the spray holes in nozzle tip.

   WARNING: ALWAYS WEAR APPROVED SAFETY GLASSES WHEN OPERATING THE TESTER. VOLATILE LIQUIDS CAN BE EXTREMELY FLAMMABLE WHEN VAPORIZED. AVOID ANY CONDITIONS (SPARKS, OPEN FLAMES, LIT CIGARETTES, ETC.) WHICH MIGHT IGNITE THE FLUID USED DURING THE TEST PROCEDURE. THE ONLY LIQUID APPROVED FOR USE IN THIS TESTER IS SAE CALIBRATION NO. 208629, OR EQUIVALENT CALIBRATION FLUID (SAE J968D OR ISO 4113).

   WHEN A NOZZLE IS BEING TESTED OR IS IN OPERATION, KEEP HANDS AND OTHER PARTS OF THE BODY AWAY FROM THE SPRAYING NOZZLE. THE LIQUID SPRAY LEAVES THE NOZZLE TIP WITH SUFFICIENT FORCE TO PENETRATE THE SKIN AND CAUSE SERIOUS INJURY. THE NOZZLE TIP SHOULD BE ENCLOSED IN A TRANSPARENT RECEPTACLE IF AVAILABLE.

4. Check nozzle opening pressure. Open gauge valve and build up line pressure by slowly depressing handle until nozzle opens (sprays fuel). Observe gauge to determine pressure at which nozzle opens, then repeat operation until accurate opening pressure is established. Normal operating pressure of the nozzle is 1957-2030 psi (13,500-14,000 kPa).

   If opening pressure is not within specification, adjust be replacing shim with one of the correct thickness (Fig. 31). Each 0.05mm (0.002 inch) change in shim thickness changes opening pressure by 500 kPa (72.5 psi) (Fig. 32).

   NOTE: Chatter will vary from nozzle to nozzle as will the sound. While nozzle chatter is acceptable, a lack of chatter is not criteria for considering the nozzle to be defective.

Injection Nozzle Testing

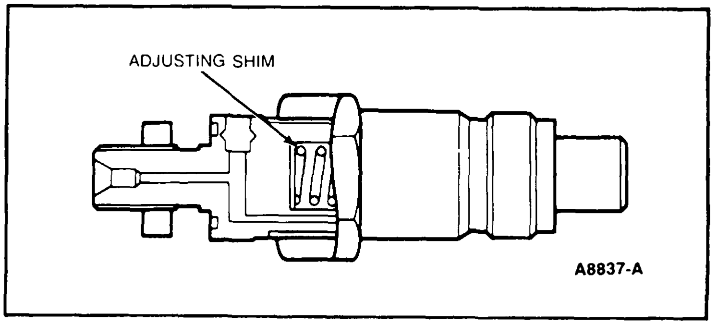


Figure 31 Adjusting Shim Location

QUICK REFERENCE NOZZLE SHIM ADJUSTMENT CHART

Part No.	Thickness (mm)	Resulting Pressure Change (kPa)	Part No.	Thickness (mm)	Resulting Pressure Change (kPa)
E73Z-9M557-A	1.00	Base	E73Z-9M557-L	1.50	5000
E73Z-9M557-B	1.05	500	E73Z-9M557-M	1.55	5500
E73Z-9M557-C	1.10	1000	E73Z-9M557-N	1.60	6000
E73Z-9M557-D	1.15	1500	E73Z-9M557-P	1.65	6500
E73Z-9M557-E	1.20	2000	E73Z-9M557-R	1.70	7000
E73Z-9M557-F	1.25	2500	E73Z-9M557-S	1.75	7500
E73Z-9M557-G	1.30	3000	E73Z-9M557-T	1.80	8000
E73Z-9M557-H	1.35	3500	E73Z-9M557-U	1.85	8500
E73Z-9M557-J	1.40	4000	E73Z-9M557-V	1.90	9000
E73Z-9M557-K	1.45	4500	E73Z-9M557-W	1.95	9500

CA8838-B

Figure 32 Adjusting Shim Chart

Injection Nozzle Testing

5. Check for tip leakage. Wipe nozzle tip dry. Operate test pump to maintain pressure at 1595 psi (11,000 kPa) below opening pressure of the nozzle. Nozzle tip should remain dry without an accumulation of fuel drops at spray holes. A slight wetting after about 5 seconds is permissible if no droplets are formed.

   NOTE: Do not wipe tip with fingers as this will tend to draw the fuel present in the sac hole through the orifice and falsely indicate a leak, causing rejection of a good nozzle.

6. Check fuel leak-off. Operate test pump in quick strokes and observe flow of fluid from fuel return ports of nozzle. A very slight leak-off, one to two drops per stroke, is normal. If fluid squirts from fuel return port when test pump is operated, nozzle is faulty and must be replaced.

7. Check spray pattern. Operate test pump in smooth, even strokes and observe pattern of fluid spraying from nozzle tip. Only the first 76mm (3 inches) of spray from the end of the nozzle is important. The spray should be finely atomized in an even, straight pattern. The nozzle is defective if the spray pattern is lopsided (not concentric with nozzle axis) or uneven, or if fuel comes out in droplets or in a solid stream (Fig. 33). If nozzle fails spray pattern test, clean nozzle as described in Step 8 and repeat test.

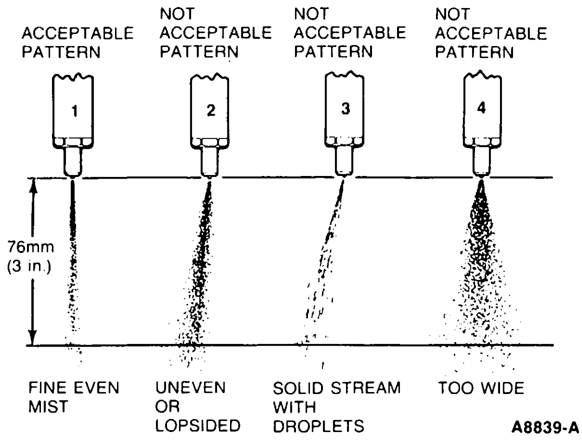


Figure 33 Injection Nozzle Spray Pattern

If nozzle passes the prior tests, it is suitable for further service in the engine following external cleaning and removal of accumulated carbon. Nozzles showing irregular spray pattern, leakage at nozzle tip spray holes, excessive fuel leak-off or opening pressure below minimum permissible limit should be serviced or replaced depending upon the warranty status.

8. Clean nozzles. After testing, place nozzle(s) in a cold Rotunda Decarbonizing Solution, or equivalent, for one hour, or clean with an appropriate sonic cleaner and cleaning fluid. After removing nozzle(s) from the solution, clean accumulated carbon with a brass wire brush and scrappers from nozzle cleaning kit 014-00301 or equivalent (Fig. 13). With carbon removed, wash off the outside surfaces of the nozzle(s). Wash protective caps and reinstall on nozzle ends.

OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS

ORDERING INFORMATION
A special order form is included in the back of this manual for your convenience if you desire to order.

ENGINE EMISSIONS FACTS BOOK

- The manual contains complete specifications for each calibration number.
- Published at the conclusion of the model year.

ELECTRICAL & VACUUM TROUBLESHOOTING MANUAL (EVTM)

- Available for all passenger car and light truck vehicles, this publication provides schematics of all electrical and vacuum circuits. Wiring diagrams show how the circuit is powered. Troubleshooting hints are provided to point the technician in a general direction but are not step by step procedures.
- Available in the first quarter of the model year. (One manual for each passenger car and light truck family.)

WIRING & VACUUM DIAGRAMS

- This publication contains wiring diagrams for all Ford and Lincoln/Mercury passenger car and light truck vehicles. A Power Distribution system illustrates the power distribution throughout each vehicle. In addition, all individual electrical circuits are shown for each vehicle line.
- Available in the first quarter of the model year.

Service Specifications Manuals

(CAR AND TRUCK)

- These manuals contain all specifications including maintenance and lubrication contained in the Shop Manuals in a handy pocket size for easy reference.
- Available in the first quarter of the model year.

SECTION 22

Diesel Diagnostics—2.3L Turbo Engine

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Preliminary Checkout

This Section covers adjustments, diagnostics, and test procedures for the 2.3L Turbocharged diesel engine Super Quick Glow Plug System and Fuel Injection System.

Checkout

- Visually inspect the engine compartment to ensure all wiring harness and fuel lines are properly routed, free of kinks and not contacting chassis or engine components and securely connected.
- Examine all wiring harnesses and connectors for insulation damage, burned, overheated, loose or broken conditions.
- Be certain the batteries are fully charged.
- All accessories should be OFF during testing and diagnosis.

Test Equipment

The following test equipment (Figures 1 through 4) is required for adjusting idle speed and timing.

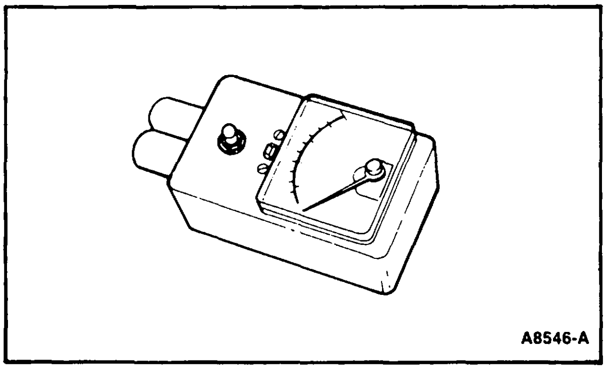


Figure 1 Rotunda 099-00001 Photoelectric Tachometer (For Engine RPM Checking Only)

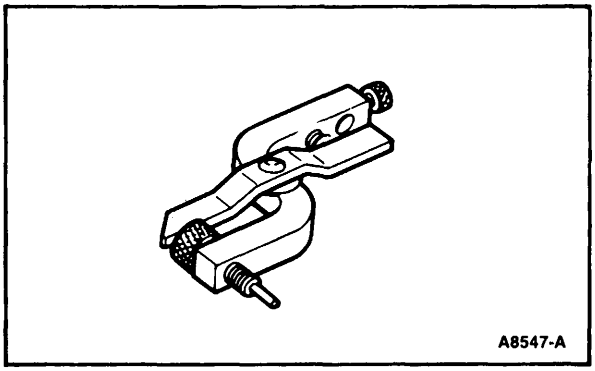


Figure 2 Rotunda 014-00303 Static Timing Gauge Adapter (D83T-9000-D)

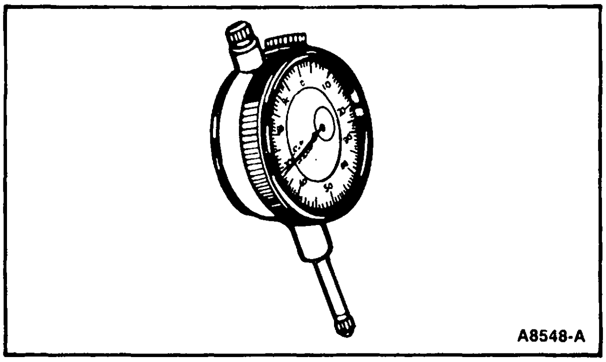


Figure 3 D82L-4201-A Metric Dial Indicator

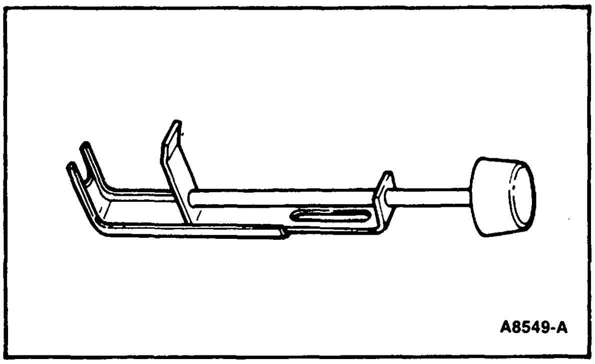


Figure 4 Rotunda 014-00302 Throttle Control (D83T-9000-E)

The following test equipment (Figure 5) is required for performing the Engine Performance Diagnostic Procedure.

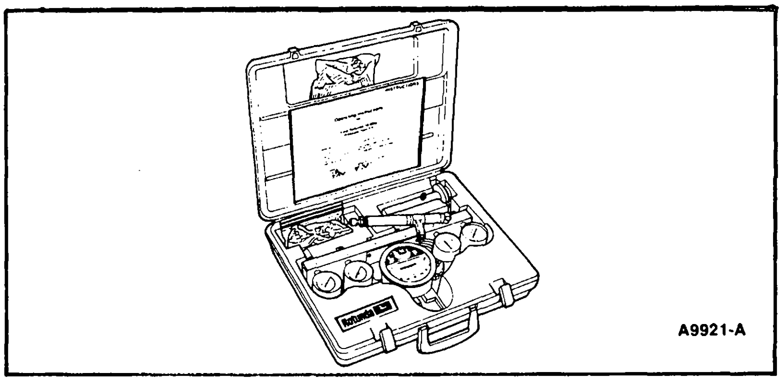


Figure 5 Rotunda 014-00702 Pressure Test Kit used with Pressure Test Adapter Kit 014-00728

Test Equipment

The following test equipment (Figures 6 and 7) is required for performing the Super Quick Glow Plug System Diagnostic Procedure.

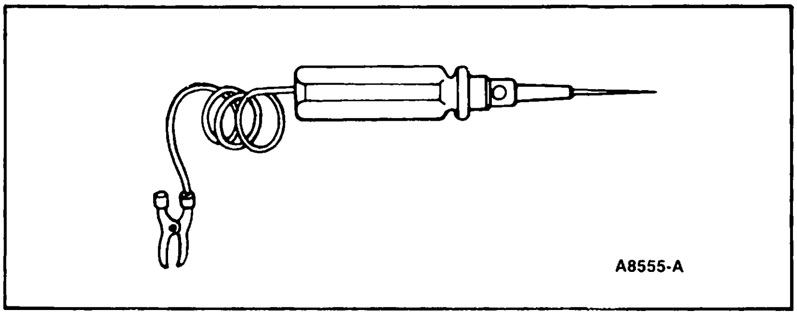


Figure 6 12-Volt Test Lamp

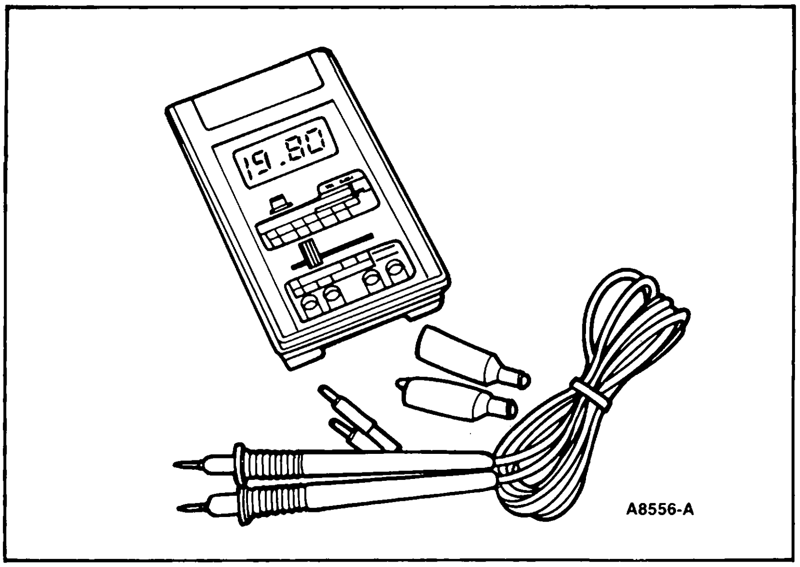


Figure 7 Rotunda 007-00001 Digital Volt-Ohm Meter

Test Equipment

The following test equipment (Figures 8 and 9) is required for Injection Nozzle testing and cleaning.

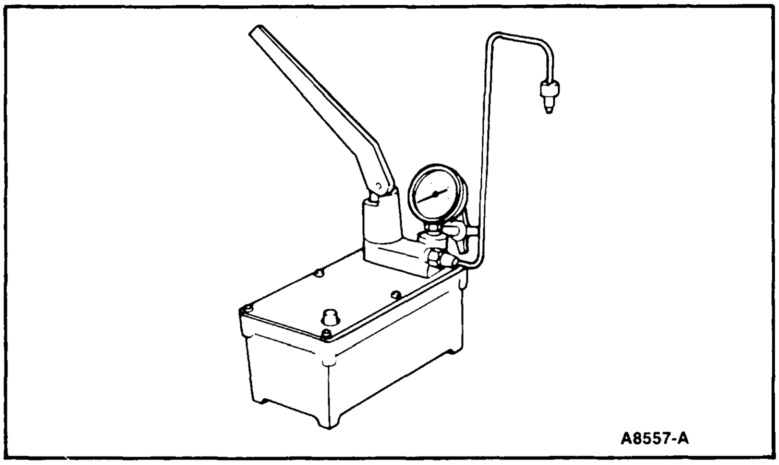


Figure 8 Rotunda 014-00300 Injector Nozzle Tester Special Service Tool D83T-9000-F

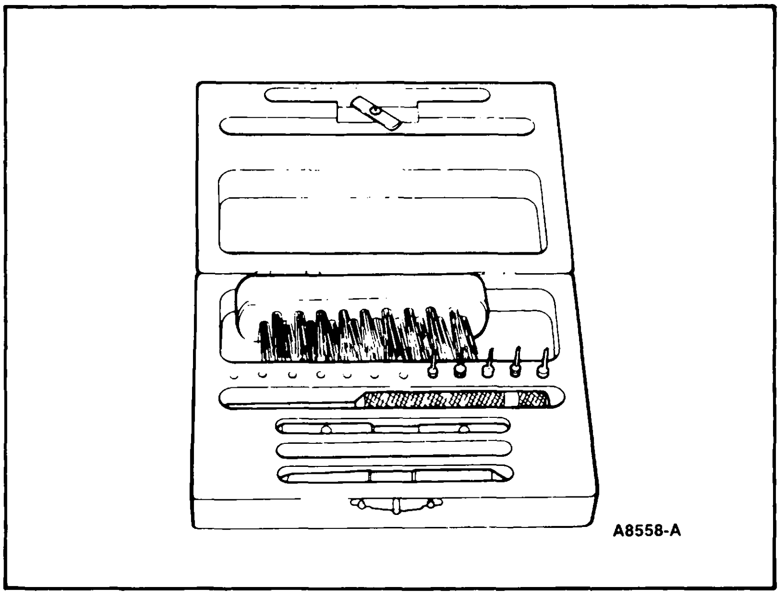


Figure 9 Rotunda 014-00301 Injector Nozzle Cleaning Kit Special Service Tool D83T-9000-G

Idle Speed Setting Procedures

Curb Idle Speed Adjustment

1. Place transmission in NEUTRAL.
2. Turn all lamps and accessories off (no load).
3. Bring engine up to normal operating temperature.
   NOTE: Be sure engine temperature is above 85-90°C (185-205°F), and that fast idle is off.
4. Be sure that curb idle adjusting screw is against the stop. If not, service the vehicle throttle linkage.
5. Run the engine between 2000 rpm and 3000 rpm for about five seconds, with transmission in NEUTRAL.
6. Run the engine at idle for two minutes.
7. Check curb idle speed using Rotunda model 099-00001 or equivalent. Curb idle speed is specified on the Vehicle Emission Control Information (VECI) decal. Adjust idle speed to specification, if necessary, using the idle speed adjusting screw (Figure 10).

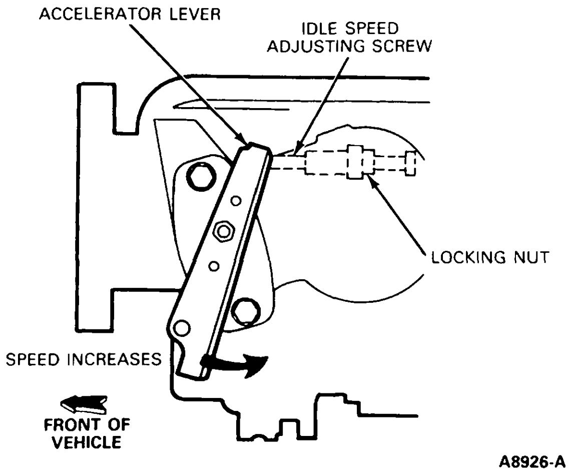


Figure 10 Idle Speed Setting Screw

NOTE: Fast idle speed is not adjustable.

Injection Pump Timing

1. Remove top timing belt cover.
2. Rotate engine until No. 1 piston is at TDC on the compression stroke. Verify this by checking timing marks (Figure 11).

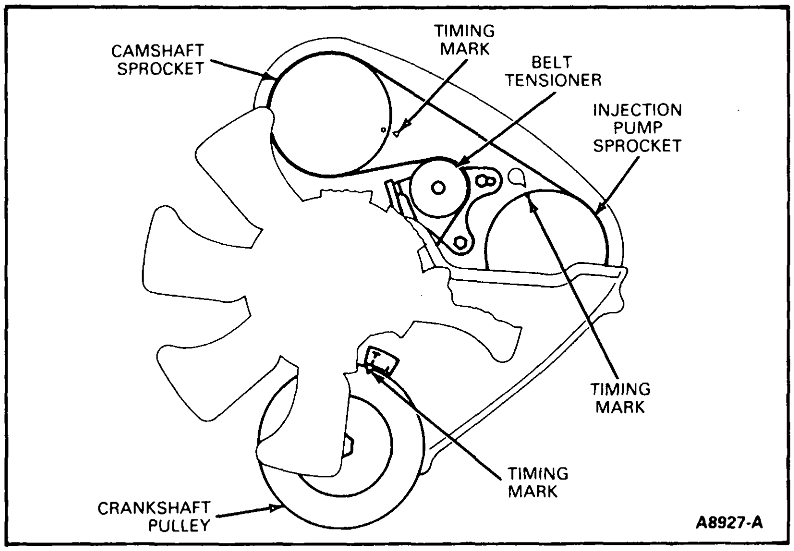


Figure 11 Timing Mark Alignment

3. If engine temperature is below 50°C (122°F), bypass the cold start mechanism as follows:
   - Insert screwdriver as shown in Figure 12 and rotate fast idle lever.
   - Insert a spacer or a wrench at least 7mm (0.27-inch) thick between cold start advance lever and the cold start device (Figure 12).

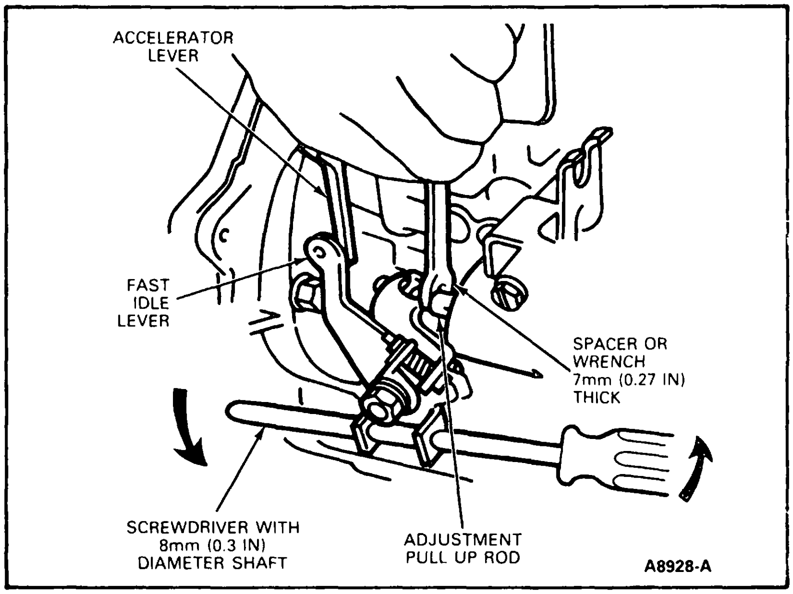

ACCELERATOR LEVER
FAST IDLE LEVER
SPACER OR WRENCH 7mm (0.27 IN) THICK
SCREWDRIVER WITH 8mm (0.3 IN) DIAMETER SHAFT
ADJUSTMENT PULL UP ROD
A8928-A

Figure 12 Bypassing Cold Start Device

Injection Pump Timing

4. Loosen, but do not remove, the two mounting bolts and two nuts attaching the injection pump to the mounting bracket and front cover (Figure 13).
5. To prevent the delivery valve holders from turning with the fuel line nuts, loosen, but do not remove, the nuts securing the fuel lines to the injection pump using a backup wrench.
6. Remove the timing plug bolt from the center of the fuel injection pump hydraulic head.
7. Install adapter Rotunda model 014-00303 or equivalent, into the port in the hydraulic head (Figure 14).
8. Mount Tool D82L-4201-A or equivalent dial indicator, in timing adapter with a minimum preload of 0.25mm (0.10-inch) (Figure 14).

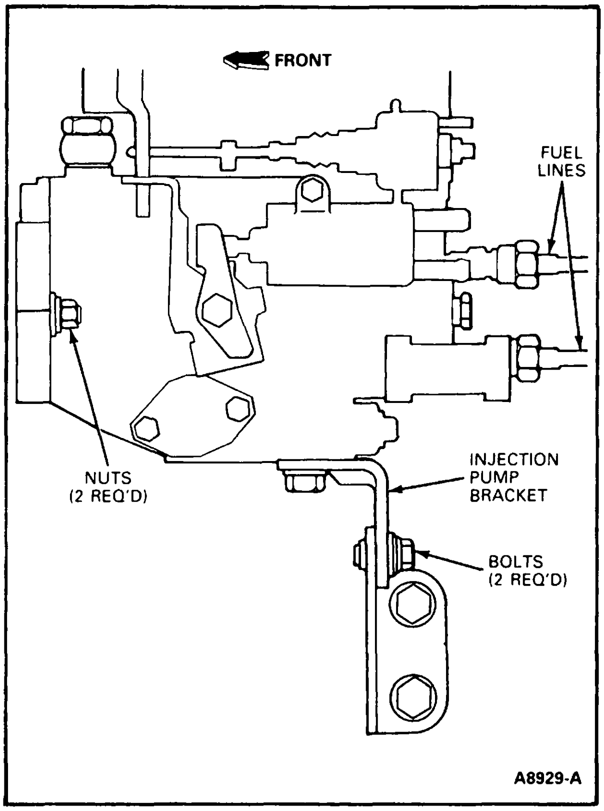


Figure 13 Injection Pump Mounting Hardware

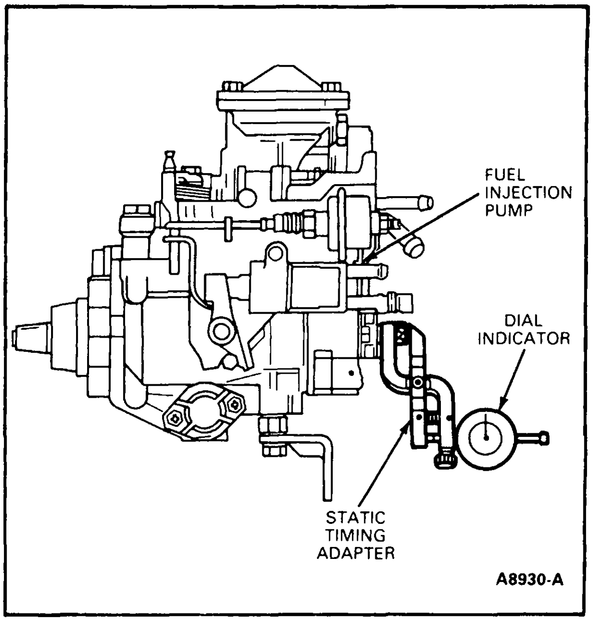


Figure 14 Timing Adapter and Dial Indicator Installation

Injection Pump Timing

9. Rotate the crankshaft approximately 30 degrees counterclockwise (Figure 15). Then, set the dial Indicator to zero.
10. Rotate the crankshaft clockwise to 5 degrees ATDC and check that the dial indicator indicates 1 ± 0.03mm (0.0394 ± 0.0011-inch) (Figure 16).
11. If the timing is out of specification, rotate the injection pump body until the dial indicator indicates specification. Rotate the pump clockwise if the reading is more than specification, or counterclockwise if less than specification (Figure 17). Tighten the injection pump mounting nuts to 15-21 N·m (11-15 lb-ft) and tighten the bolts to 20-26 N·m (15-19 lb-ft).
12. After tightening injection pump mounting bolts and nuts, repeat Steps 9 and 10 to ensure that the injection timing has not changed.
13. Tighten the fuel line nuts at the injection pump to 23-36 N·m (17-26 lb-ft).
14. Using a new copper gasket, install the injection timing plug bolt and tighten to 14-20 N·m (10-14 lb-ft) (Figure 18).
15. Install the upper timing belt cover.
16. Run the engine and check for fuel leaks at the injection pump.

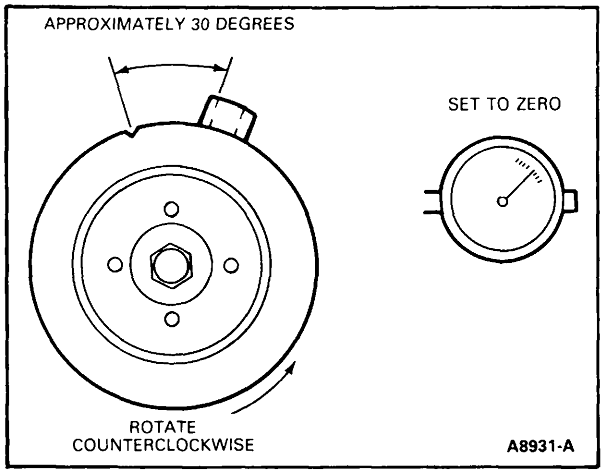


Figure 15 Setting Dial Indicator To Zero

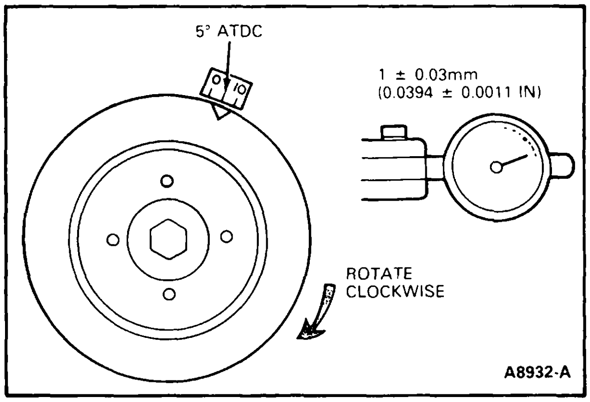


Figure 16 Injection Timing—Check

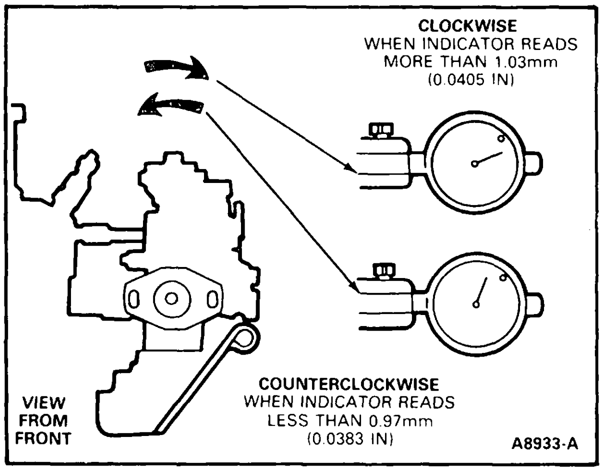

CLOCKWISE
WHEN INDICATOR READS MORE THAN 1.03mm (0.0405 IN)
COUNTERCLOCKWISE
WHEN INDICATOR READS LESS THAN 0.97mm (0.0383 IN)
VIEW FROM FRONT
A8933-A

Figure 17 Injection Timing Adjustment

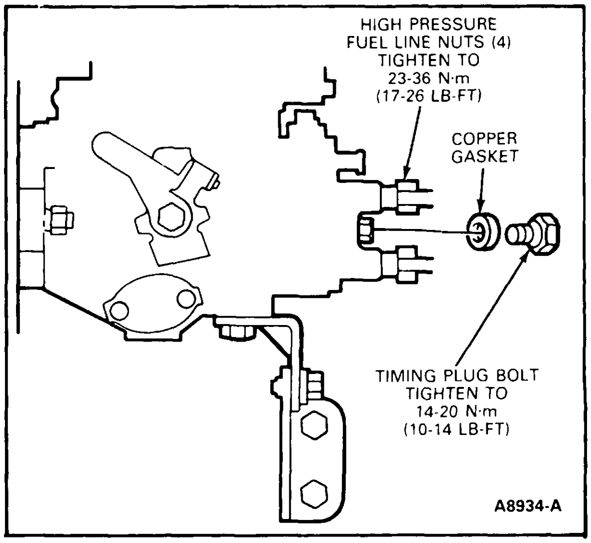

HIGH PRESSURE FUEL LINE NUTS (4) TIGHTEN TO 23-36 N·m (17-26 LB-FT)
COPPER GASKET
TIMING PLUG BOLT TIGHTEN TO 14-20 N·m (10-14 LB-FT)
A8934-A

Figure 18 Timing Plug Bolt Installation

System Description and Diagnosis

This portion of this Section contains a brief description of the 2.3L turbo diesel engine Super Quick Glow Plug System and Fuel Injection System. It also contains detailed diagnostic procedures for these systems.

The diagnostic procedures are broken into two parts. The first part is Symptom Analysis. This Section should be consulted first, as it will direct you to perform a specific repair or it will direct you to a specific diagnostic procedure.

The second part contains the Super Quick Glow Plug System and Engine Performance diagnostic procedures. At the beginning of each of these procedures, there is an explanation of how to use that procedure. Read this explanation before performing the tests.

Super Quick Glow Plug System

This system is used to enable the engine to start more quickly when the engine is cold. It consists of the four glow plugs, the control module, two relays, a dropping resistor assembly, coolant temperature sensor, and connecting wiring. Relay power and feedback circuits are protected by fuse links in the wiring harness. The control module is protected by a separate 10A fuse in the fuse panel, (Figure 19).

When the ignition is turned to RUN, relay No. 1 closes and full system voltage is applied to the glow plugs. If engine coolant temperature is below 30°C (86°F), relay No. 2 also closes at this time. After the glow plugs reach their operating temperature, the control module turns off relay No. 1, for starting. If the ignition switch is left in the RUN position about three seconds more without cranking, the control opens relay No. 1 and current to the plugs stops to prevent overheating.

When the engine is cranked, the control module cycles relay No. 1 on for one to six seconds. After the engine starts, alternator output signals the control module to stop the No. 1 relay and the afterglow function takes over.

If the engine coolant temperature is below 30°C (86°F), the No. 2 relay remains closed. This applies reduced (6-7.6) voltage to the glow plugs through the glow plug dropping resistor. When the coolant temperature is above 30°C (86°F), the control module opens relay No. 2, cutting off all current to the glow plugs.

Super Quick Glow Plug System

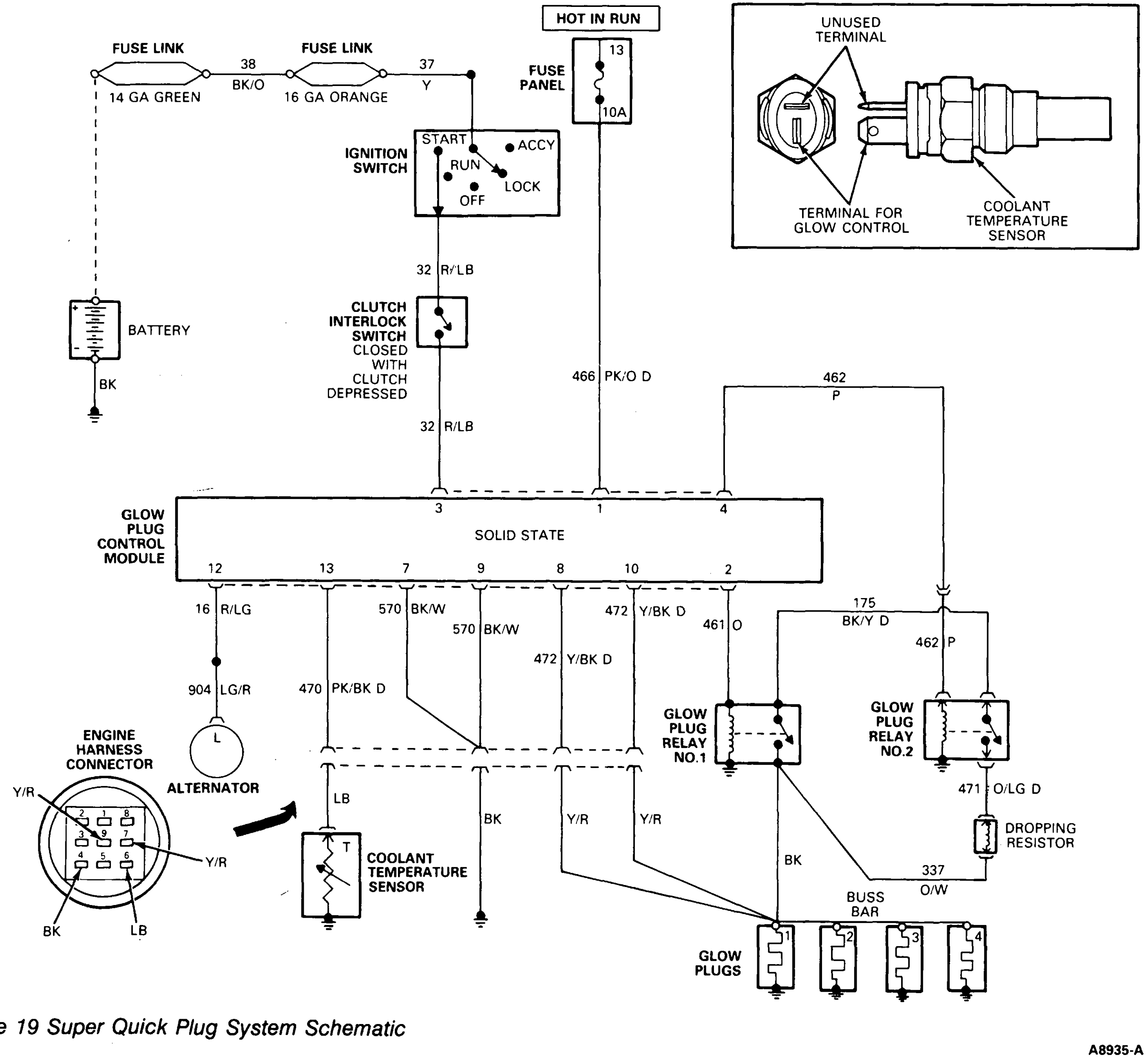


Figure 19 Super Quick Plug System Schematic

Fuel System Description

The fuel in the tank is introduced into the fuel lines by an electric pump mounted on the frame rail (Figure 20). A fuel filter also is mounted on the frame rail. This filters any impurities in the fuel before it reaches the fuel pump. The fuel filter should be changed every 8,300 Km (5000 miles).

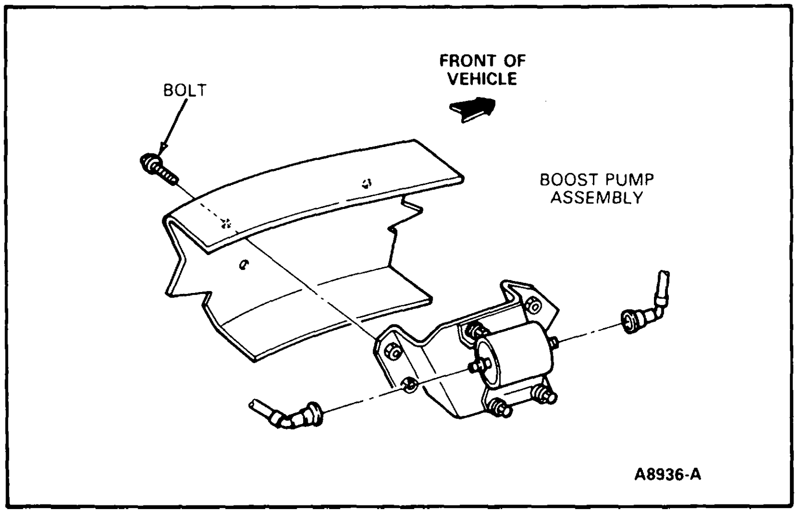


Figure 20 Electric Fuel Pump

Any water in the fuel is removed by the fuel conditioner mounted on a bracket on the LH rear of the engine (Figure 21). The fuel is further filtered by the conditioner before it reaches the injection pump. When the fuel conditioner contains 50cc (3 cu-in) or more of water, a sensor turns an instrument panel indicator lamp on to warn the driver to drain the fuel conditioner.

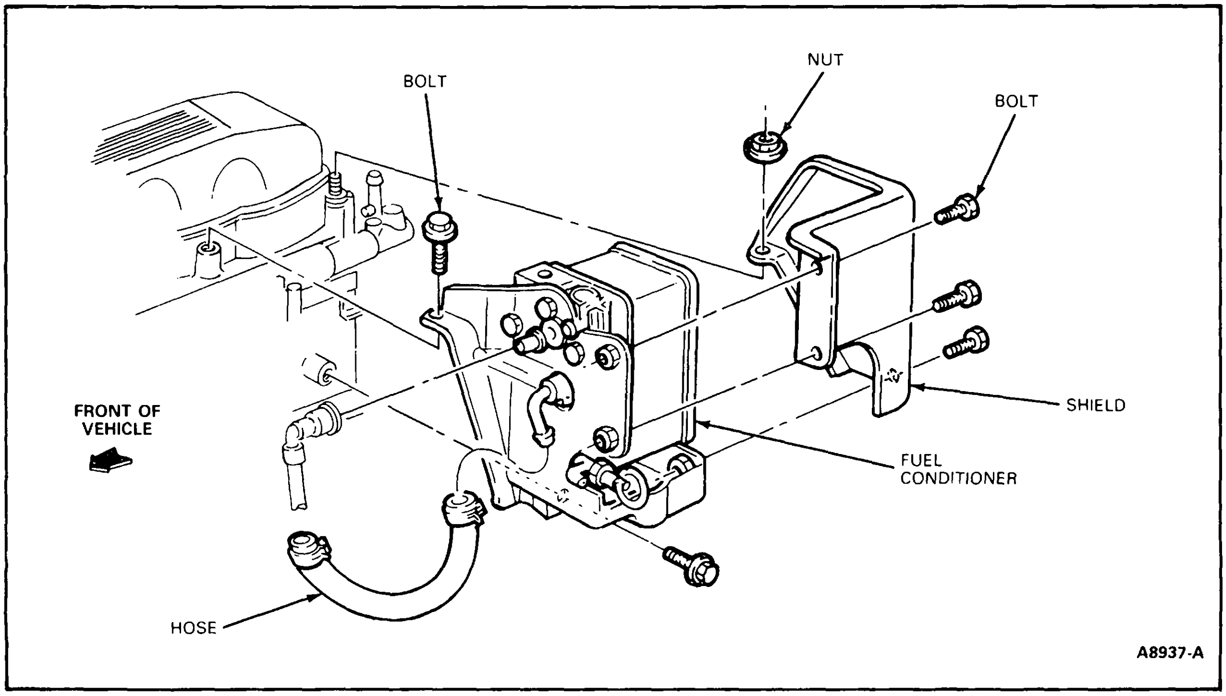


Figure 21 Fuel Conditioner

Fuel System Description

The fuel supplied to the injection pump is pressurized by a vane type pump and flows into the pump body. Fuel reaches the high pressure chamber of the pump at the upper part of the plunger. Injection is controlled by a sleeve, linked with the accelerator, in an amount proportionate to the degree of acceleration depression. The pressure of the fuel in the injection pump will be controlled in accordance with the engine speed by the operation of the vane pump and the regulating valve built into the pump.

The fuel sent to the plunger is highly pressurized and is forced through the delivery valve, into the injection line, then to the injection nozzle. The fuel is then injected into each cylinder in the proper injection order.

Any fuel leaking at the sliding section of the nozzle needle valve at the time of injection, and any surplus fuel in the injection pump housing will be returned to the fuel tank through the overflow line. The surplus fuel circulates through the injection pump to cool and lubricate the pump.

A fuel cutoff solenoid, located on the injection pump, is activated with the ignition in RUN or START and interrupts the fuel flow on the plunger inlet side of the injection pump when the ignition is turned to OFF. This closes the intake port of the plunger and stops the engine.

Figure 22 shows the fuel lines and components which make up the fuel system.

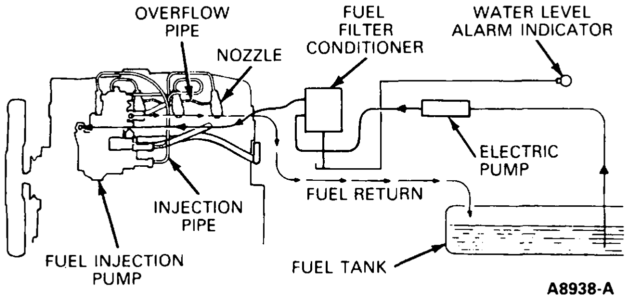
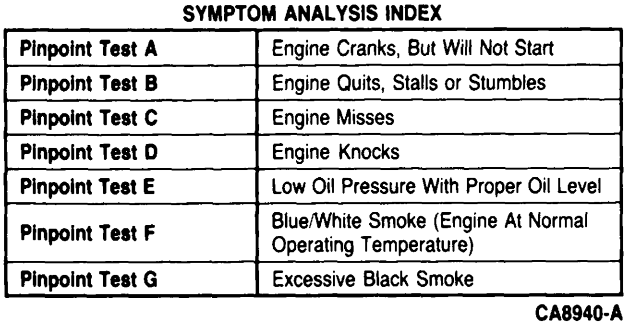


Figure 22 Fuel System

Symptom Analysis

The Symptom Analysis Diagnostic Procedures should be consulted first. These will direct you to a service to be performed or to either the Super Quick Glow Plug System Diagnostic procedure or to the Engine Performance Diagnostic procedure.



SYMPTOM ANALYSIS INDEX

Pinpoint Test A	Engine Cranks, But Will Not Start
Pinpoint Test B	Engine Quits, Stalls or Stumbles
Pinpoint Test C	Engine Misses
Pinpoint Test D	Engine Knocks
Pinpoint Test E	Low Oil Pressure With Proper Oil Level
Pinpoint Test F	Blue/White Smoke (Engine At Normal Operating Temperature)
Pinpoint Test G	Excessive Black Smoke

CA8940-A

Engine Cranks But Will Not Start

TEST STEP	RESULT ▶	ACTION TO TAKE
A1 CHECK CRANKING SPEED ● Observe engine rpm while cranking engine. ● Cranking speed should be a minimum of 150 rpm.	OK ▶	GO to A2.
	~~OK~~ ▶	REFER to the Ranger/Bronco II Shop manual.
A2 CHECK GLOW PLUG RELAY ● Open hood. ● Glow plug relay should click when ignition is turned to RUN. **NOTE: Engine coolant temperature must be below 30°C (86°F).**	OK ▶	GO to A3.
	~~OK~~ ▶	GO to Super Quick Glow Plug System Diagnosis.
A3 CHECK FUEL FLOW ● Loosen one injection nozzle line nut (1/2 to 1 turn) while cranking engine. ● Fuel should discharge. ● Tighten line nut after cranking engine.	OK ▶	GO to Super Quick Glow Plug System Diagnosis.
	~~OK~~ ▶	GO to A4.
A4 CHECK CURRENT TO FUEL SHUT-OFF SOLENOID ● Turn ignition to RUN. ● Using a 12V test lamp, check that voltage is available to solenoid.	OK ▶	GO to A5.
	~~OK~~ ▶	SERVICE or REPLACE circuit as necessary. REPEAT A4.
A5 CHECK FUEL SHUT-OFF SOLENOID ● With ignition in RUN, disconnect and connect connector at fuel shut-off solenoid. ● Solenoid should click.	OK ▶	GO to Engine Performance Diagnosis.
	~~OK~~ ▶	REPLACE fuel shut-off solenoid. REPEAT A5.

Engine Quits, Stalls or Stumbles

TEST STEP	RESULT ▶	ACTION TO TAKE
B0 IDLE SPEED		
● Perform Test Step **EPC.5** in the Engine Performance Diagnostic Procedure.	OK ▶	GO to B1.
	~~OK~~ ▶	ADJUST idle speed as outlined under Adjustments.
B1 ENERGIZE-TO-RUN SOLENOID (ETR)		
● Check ETR solenoid (terminal located at top rear of injection pump) for dirt/ corrosion and loose/broken electrical connection. While cranking, voltage must be at least 9 volts.	OK ▶	GO to B2. or B3. as required.
	~~OK~~ ▶	CLEAN, SERVICE or REPLACE terminal connection. REPEAT Test Step B1.
B2 COLD ADVANCE SYSTEM (COLD ENGINE)		
● Check that cold start timing advance/fast idle device has moved lever off idle stop. **NOTE: Coolant temperature must be less than 50°C (122°F).**	OK ▶	GO to Super Quick Glow Plug System Diagnosis.
	~~OK~~ ▶	REPLACE fuel injection pump.
B3 COLD ADVANCE SYSTEM (HOT ENGINE)		
● Check that cold start timing advance is on idle stop. **NOTE: Coolant temperature must be greater than 50°C (122°F).**	OK ▶	GO to Engine Performance Diagnostic Procedure.
	~~OK~~ ▶	REPLACE fuel injection pump.

Engine Misses

TEST STEP	RESULT ►	ACTION TO TAKE
C0 DETERMINE WHEN MISS OCCURS		
• Engine will miss when cold if one or more glow plugs are not heating.	Engine misses only when cold ►	REFER to Glow Plug System Diagnostic Procedure.
	Engine misses at normal operating temperature ►	GO to C1.
C1 ISOLATE MISS		
• Loosen each injection nozzle line nut (one at a time) while running engine. Refer to Injection Nozzle Testing.	Miss not isolated to specific cylinder ►	GO to Engine Performance Diagnostic Procedure.
	Miss isolated to specific cylinder(s) ►	GO to C2.
C2 CHECK NOZZLE FUEL DELIVERY		
• Check injection nozzle fuel line(s) for kinks or restrictions as described in Shop Manual Section 22-10. • Perform injection nozzle test as described under Injection Nozzle Testing.	Nozzle(s) and lines OK ►	GO to C3.
	Nozzle(s) and/or lines Not OK ►	REPLACE damaged line(s) as described in Shop Manual Section 22-10. CLEAN or REPLACE nozzle(s) as described under Injection Nozzle Testing.
C3 CYLINDER COMPRESSION CHECK		
• Perform cylinder compression test as described in Shop Manual Section 22-10.	OK ►	GO to Engine Performance Diagnostic Procedure.
	~~OK~~ ►	GO to C4.

Engine Misses

TEST STEP	RESULT ▶	ACTION TO TAKE
C4 CHECK CRANKCASE PRESSURE		
⊙ Perform Engine Performance Diagnostic Procedure Test Step **EPC.15**.	OK ▶	SERVICE or REPLACE valve train as described in Shop Manual Section 22-10.
	~~OK~~ ▶	OVERHAUL power cylinder as described in Shop Manual Section 22-10.

Engine Knocks

TEST STEP	RESULT ▶	ACTION TO TAKE
D0 BELT DRIVEN ACCESSORIES		
• Check engine front drive components for proper operation.	OK ▶	GO to D1.
	~~OK~~ ▶	SERVICE OR REPLACE as necessary. REFER to specific accessory Shop Manual Section.
D1 ENGINE COOLANT TEMPERATURE		
• Verify engine is not overheating.	OK ▶	GO to D2.
	~~OK~~ ▶	REFER to Shop Manual Section 27-02.
D2 ISOLATE ENGINE KNOCK		
• Loosen each injection nozzle line nut (one at a time) while running engine. Refer to Injection Nozzle Testing.	Engine knock not isolated to specific cylinder ▶	GO to Engine Performance Diagnostic Procedure.
	Engine knock isolated to specific cylinder(s) ▶	GO to D3.
D3 CHECK NOZZLE FUEL DELIVERY		
• Check injection nozzle fuel line(s) for kinks or restrictions as described in Shop Manual Section 22-10.	Nozzle(s) and lines OK ▶	GO to Engine Performance Diagnostic Procedure.
• Perform injection nozzle test as described under Injection Nozzle Testing.	Nozzle(s) and/or lines not OK ▶	REPLACE damaged line(s). CLEAN or REPLACE nozzle(s) as described under Injection Nozzle Testing.

Low Oil Pressure With Proper Oil Level

TEST STEP	RESULT ▶	ACTION TO TAKE
E0 OIL PRESSURE TRANSDUCER		
⊙ Verify accuracy of oil pressure transducer. Use Adapter 5633 with Pressure Test Kit 014-00702 or equivalent. Refer to Pressure Test Kit hookup illustration.	OK ▶	GO to E1.
	~~OK~~ ▶	REPLACE transducer. REPEAT Test Step E0.
E1 CHANGE ENGINE OIL AND FILTER		
⊛ Change engine oil and filter and run engine until normal operating temperature is reached. Check oil pressure reading.	OK ▶	RETURN vehicle to customer.
	~~OK~~ ▶	SERVICE or REPLACE lubrication system components as necessary. REFER to Shop Manual Section 22-10.

Blue / White Smoke (Engine At Normal Operating Temperature)

TEST STEP	RESULT ►	ACTION TO TAKE
F0 ENGINE TEMPERATURE		
NOTE: Refer to Symptom Analysis. ● Verify that engine stabilizes in normal operating range.	OK ►	GO to F2.
	~~OK~~ ►	GO to F1.
F1 THERMOSTAT OPERATION		
● Remove thermostat. Refer to Shop Manual Section 27-04.	OK ►	CHECK coolant level. REPEAT Test Step F0.
● Test thermostat for proper operation. Refer to Shop Manual Section 27-02.	~~OK~~ ►	REPLACE thermostat. REFER to Shop Manual Section 22-10. REPEAT Test Step F0.
F2 EXCESSIVE OIL LEVEL		
● Check engine oil level indicator for excessive oil fill.	OK ►	GO to F3.
	~~OK~~ ►	DRAIN excess oil from oil pan. If problem still exists, GO to F3.
F3 FUEL RETURN		
● Perform fuel return pressure test as described in Test Step **EPC.9** of the Engine Performance Diagnostic Procedure.	OK ►	PERFORM entire Engine Performance Diagnostic Procedure.
	~~OK~~ ►	SERVICE or REPLACE fuel return line(s) as necessary. REFER to Shop Manual Section 25-50. REPEAT Test Step F3.

Excessive Black Smoke

TEST STEP	RESULT ▶	ACTION TO TAKE
G0 VERIFY SMOKE LEVEL		
NOTE: Refer to Symptom Analysis • Verify under what conditions black smoke occurs.	Light load and/or low altitude ▶	GO to G1. NOTE: For warranty claim approval Engine Performance Chart must be filled out for the following Steps **EPC.2; EPC.6; EPC.8; EPC.9; EPC.12.**
	Under heavy load ▶	Normal when going up steep grades, pulling a trailer, maximum load, maximum acceleration at high altitudes or loaded with engine at low rpm.
G1 EXHAUST SYSTEM CONDITION		
• Complete Test Step **EPC.2** of Engine Performance Diagnostic Procedure, and record problem description and results on Engine Performance Chart.	OK ▶	GO to G2.
	~~OK~~ ▶	SERVICE or REPLACE exhaust system as necessary. REFER to Shop Manual Section 26-01. If problem still exists, GO to G2.
G2 CHECK AIR CLEANER RESTRICTION		
• Complete Test Step **EPC.6** of Engine Performance Diagnostic Procedure and record results on Engine Performance Chart.	OK ▶	GO to G3.
	~~OK~~ ▶	REPLACE air filter element and/or SERVICE system. REPEAT Step G2.

Excessive Black Smoke

TEST STEP	RESULT ►	ACTION TO TAKE
G3 INJECTION PUMP TIMING		
• Complete Test Step **EPC.12** of Engine Performance Diagnostic Procedure and record results on Engine Performance Chart.	OK ►	GO to G4 .
	~~OK~~ ►	ADJUST timing. (REFER to Adjustments in this section.) If problem still exists, GO to G4 .
G4 INJECTION NOZZLES		
• Complete Test Step **EPC.14** of Engine Performance Diagnostic Procedure and record results on Engine Performance Chart.	OK ►	REPLACE injection pump as described in Shop Manual Section 22-10.
	~~OK~~ ►	REPLACE damaged injection nozzle fuel inlet lines. REFER to Shop Manual Section 22-10. CLEAN or REPLACE nozzles as described in this section, and Shop Manual Section 22-10. If problem still exists, REPLACE injection pump as described in Shop Manual Section 22-10.

Super Quick Glow Plug System Diagnosis

Use the following diagnostic chart along with the wiring schematic (Figure 19) to diagnose problems with the Super Quick Glow Plug System.

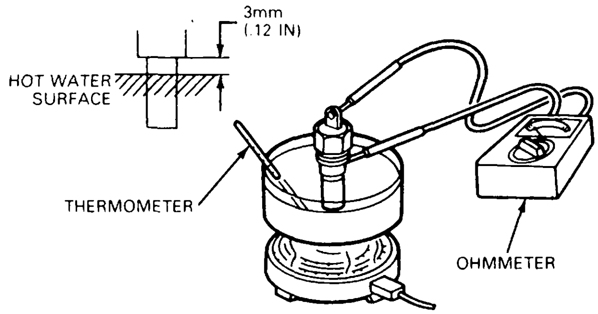
Super Quick Glow Plug System Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
H1 CHECK VOLTAGE AT GLOW PLUGS		
NOTE: Refer to Super Quick Glow Plug System schematic (Figure 19) while performing diagnosis. **NOTE: If engine coolant temperature is above 30°C (86°F), disconnect wire from coolant temperature sensor for all tests.** ● Turn ignition to RUN. ● Using a voltmeter, check voltage between glow plug buss bar and engine block. ● Voltage should be a minimum of 10V for one to six seconds after ignition is turned to RUN.	OK ▶ ~~OK~~ ▶	GO to H9. GO to H2.
H2 CHECK VOLTAGE AT RELAY NO. 1		
● Using Rotunda Digital Volt-Ohm Meter 007-00001 or equivalent, check for battery voltage on battery side of glow plug relay No. 1.	OK ▶ ~~OK~~ ▶	GO to H3. SERVICE or REPLACE circuit between battery and glow plug relay No. 1. REPEAT H1.
H3 CHECK GPCM PIN 1		
● Connect a voltmeter between Glow Plug Control Module (GPCM) Pin No. 1 and ground. ● Turn ignition to RUN. ● Voltage should be a minimum of 10V.	OK ▶ ~~OK~~ ▶	GO to H4. SERVICE or REPLACE ignition switch and/or circuit to GPCM Pin 1 as necessary. REPEAT H1.
H4 CHECK CIRCUITS TO BUSS BAR		
● Turn ignition to OFF. ● Using a Rotunda Digital Volt-Ohm Meter 007-00001 or equivalent, check for continuity of circuit between No. 1 glow plug relay and glow plug buss bar.	OK ▶ ~~OK~~ ▶	GO to H5. SERVICE or REPLACE circuit as necessary. REPEAT H1.

Super Quick Glow Plug System Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
H5 CHECK GPCM PIN 2		
○ Connect a voltmeter between GPCM Pin No. 2 and ground. ○ Turn ignition to RUN. ○ Voltmeter should indicate a minimum of 10V for one to six seconds after ignition is turned to RUN.	OK ▶	REPLACE glow plug relay No. 1. REPEAT H1.
	~~OK~~ ▶	GO to H6.
H6 CHECK GPCM PIN 13		
○ Disconnect engine coolant temperature sensor. ○ Disconnect GPCM connector. ○ Connect an ohmmeter between GPCM Pin No. 13 and ground. ○ Ohmmeter should indicate no continuity.	OK ▶	GO to H7.
	~~OK~~ ▶	SERVICE short to ground in circuit to GPCM Pin No. 13.
H7 CHECK GLOW PLUG CONTROL MODULE		
○ Connect connector to GPCM. ○ Leave engine coolant temperature sensor disconnected. ○ Connect a voltmeter between GPCM Pin No. 2 and ground. ○ Turn ignition to RUN. ○ Voltmeter should indicate a minimum of 10V for one to six seconds after ignition is turned to RUN.	OK ▶	GO to H8.
	~~OK~~ ▶	REPLACE GPCM. REPEAT H1.

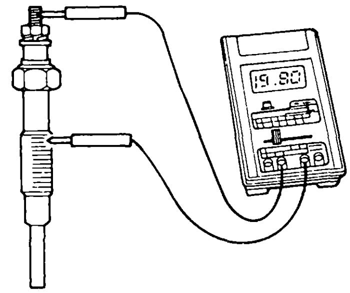
Super Quick Glow Plug System Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
H8 CHECK COOLANT TEMPERATURE SENSOR		
• Remove engine coolant temperature sensor from engine. • Place sensor in a container of water as shown. **NOTE: The water must be at a temperature of 20°C (68°F).** • Using an ohmmeter, check resistance of sensor. • Resistance should be 2,800 to 3,800 ohms.  3mm (.12 IN) HOT WATER SURFACE THERMOMETER OHMMETER	OK ▶ ~~OK~~ ▶	SERVICE circuit between GPCM Pin 13 and coolant temperature sensor. REPEAT H1. REPLACE sensor. REPEAT H1.
H9 CHECK GLOW PLUG RELAY NO. 2		
• Connect a voltmeter between glow plug buss bar and ground. • Turn ignition to RUN and observe voltmeter. • Voltage should be 5V to 8V for six seconds after No. 1 glow plug relay turns off.	OK ▶ ~~OK~~ ▶	GO to H14. GO to H10.
H10 CHECK CIRCUIT		
• Using a voltmeter, check for battery voltage on circuit at glow plug relay No. 2.	OK ▶ ~~OK~~ ▶	GO to H11. SERVICE or REPLACE circuit between battery and glow plug relay No. 2. REPEAT H1.

Super Quick Glow Plug System Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
H11 CHECK CIRCUIT		
○ With ignition off, check continuity of circuit between glow plug relay No. 2 and glow plug buss bar.	OK ▶	GO to H13 .
	~~OK~~ ▶	GO to H12 .
H12 CHECK DROPPING RESISTOR		
○ Disconnect dropping resistor from wiring harness. ○ Set ohmmeter multiply-knob to X1. ○ Check continuity of dropping resistor. **WARNING: DROPPING RESISTOR BECOMES EXTREMELY HOT DURING GLOW PLUG SYSTEM OPERATION.**	OK ▶	SERVICE or REPLACE circuit as necessary.
	~~OK~~ ▶	REPLACE dropping resistor. REPEAT H1 .
H13 CHECK GPCM PIN 4		
○ Connect a voltmeter between GPCM Pin No. 4 and ground. ○ Turn ignition to START (engine cranking) and observe voltmeter. ○ Does voltmeter indicate 10V or more for seven or more seconds after ignition is turned to START?	YES ▶	REPLACE glow plug relay No. 2. REPEAT H9 .
	NO ▶	REPLACE GPCM. REPEAT H1 .
H14 CHECK GPCM PIN 4		
○ Connect a voltmeter between GPCM Pin No. 4 and ground. ○ Turn ignition to START and observe voltmeter. ○ Does voltmeter indicate nine or more volts while cranking engine?	YES ▶	GO to H16 .
	NO ▶	GO to H15 .
H15 CHECK GPCM STARTING SIGNAL		
○ Connect a voltmeter between GPCM Pin No. 3 and ground. ○ Turn ignition to START and observe voltmeter. ○ Does voltmeter indicate nine or more volts while cranking engine?	YES ▶	REPLACE GPCM. REPEAT H1 .
	NO ▶	SERVICE or REPLACE ignition switch and/or wiring to GPCM Pin 3. REPEAT H1 .

Super Quick Glow Plug System Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
H16 CHECK GLOW PLUGS ● Disconnect glow plug buss bar. ● Remove glow plugs from engine and inspect for breakage and/or cracks. **CAUTION: Use extreme care when servicing glow plugs to avoid damage. Do not use a glow plug that has been damaged or dropped.**	OK ▶ ~~OK~~ ▶	GO to H17. CHECK engine compression. REFER to Section 22-10, Ranger/Bronco II Shop manual. GO to H17.
H17 CHECK GLOW PLUG RESISTANCE ● Using an ohmmeter, measure resistance of each glow plug. **NOTE: Glow plugs must be at a temperature of 20°C (68°F).** ● Resistance should be approximately 0.23 ohms or less. 	OK ▶ ~~OK~~ ▶	GO to H18. REPLACE glow plug(s) as necessary. INSTALL glow plugs and buss bar. REPEAT H1.
H18 CHECK GPCM PIN 9 AND PIN 7 ● Disconnect connector from GPCM. ● Disconnect engine harness connector. ● Using an ohmmeter, check continuity between GPCM Pin 7 and engine harness connector Pin 4 (harness side). Then check continuity between GPCM Pin 9 and engine harness connector Pin 4 (harness side).	OK ▶ ~~OK~~ ▶	LEAVE engine harness connector disconnected. GO to H19. SERVICE or REPLACE wiring between GPCM Pin 7 and/or Pin 9 and engine harness connector Pin 4. REPEAT H1.

Super Quick Glow Plug System Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
H19 CHECK FOR GROUND		
⊙ Connect an ohmmeter between engine harness connector Pin 4 (engine side), and ground, and check continuity.	OK ▶	CONNECT engine harness connector. GO to H20 .
	~~OK~~ ▶	SERVICE or REPLACE wiring between engine harness connector Pin 4 and ground. REPEAT H1 .
H20 START ENGINE		
⊙ Turn ignition to START.	Engine starts ▶	TURN ignition off. GO to H21 .
	Engine does not start ▶	Problem is not in glow plug system. CONNECT coolant temperature sensor. GO to Engine Performance Diagnosis.
H21 CHECK AFTER GLOW		
⊙ Connect a voltmeter between glow plug buss bar and ground.	OK ▶	Glow plug system OK. Problem is elsewhere in vehicle.
⊙ Start engine and observe voltmeter.	No voltage after engine starts ▶	TURN engine off. GO to H22 .
⊙ Voltmeter should indicate 5V to 8V for 6 to 30 seconds after engine starts.	5V to 8V for 30 seconds or more after engine starts. ▶	TURN engine off. GO to H24 .

Super Quick Glow Plug System Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
H22 CHECK GPCM PIN 12		
• Connect a voltmeter between GPCM Pin 12 and ground. • Start engine and observe voltmeter.	Approximately 14V. ▶	Turn engine off. GO to **H23** .
	12V or less. ▶	SERVICE or REPLACE wiring between GPCM Pin 12 and alternator. REPEAT **H1** .
H23 CHECK GPCM PIN 4		
• Connect a voltmeter between GPCM Pin 4 and ground. • Start engine. • Does voltmeter indicate 10 or more volts for 6 to 30 seconds after engine starts.	YES ▶	Steps H9 through H13 were performed incorrectly. GO to **H9** .
	NO ▶	REPLACE GPCM. REPEAT **H1** .
H24 DISCONNECT COOLANT TEMPERATURE SENSOR		
• Connect a voltmeter between glow plug buss bar and engine block. • Connect coolant temperature sensor. • Start engine. • Observe voltmeter while disconnecting coolant temperature sensor connector. • Voltmeter should indicate 5V to 8V with sensor connected and no voltage with sensor disconnected.	OK ▶	Glow plug system is OK. Problem is elsewhere in vehicle.
	~~OK~~ ▶	GO to **H21** .

Engine Performance Diagnostic Procedure

The Engine Performance Diagnostic Procedure begins with those items which are the high frequency, easy-to-diagnose problems, and progresses to the low frequency, hard to diagnose problems. Use of this procedure will promote rapid as well as accurate diagnosis.

The Engine Performance Diagnostic Procedure follows, step by step, the Engine Performance Chart. Each test Step is labeled to coincide with the Engine Performance Chart Steps.

NOTE: Under no circumstances should the fuel injection pump be replaced until the Engine Performance Chart has been completely filled out. The only exception to this is in the case of Excessive Black Smoke (Symptom Analysis Diagnostic Procedure G). In this case, only those Steps specified need to be filled out. Warranty claims for the fuel injection pump will not be accepted unless the Engine Performance Chart is filled out as specified and all tamper-proof seals are intact.

NOTE: Repair each problem detected, before going on to the next test Step. If the repair corrects the original complaint, it will not be necessary to proceed to the next test Step. However, if the complaint is not corrected, continue with the test until the complaint is corrected.

The following explanations refer to the basic test Steps of the Engine Performance Diagnostic Procedure and Chart. They give a brief description of the effect on performance these problems can create, giving you an understanding of the importance of each test Step.

1. **External Leakage:** Fuel leakage can be a reason for diesel fuel smell, low economy, poor performance or noise. Oil leakage can be a reason for high oil consumption. An air intake system leak can shorten engine life, especially under dusty conditions. Coolant leakage can result in engine overheating.

2. **Exhaust System Condition:** Kinks or dents in the exhaust system can cause high exhaust back pressure. This can result in loss of power and high smoke levels.

3. **Fuel System Condition:** Kinks in the fuel lines or hoses can block or restrict fuel flow and loose connections can leak air into the fuel. This can result in loss of power and high smoke levels.

4. **Fuel Quality:** Diesel engines need clean fuel, free of air, dirt and water. Any contamination may result in poor engine performance.

5. **Accelerator Linkage:** If the accelerator linkage is improperly adjusted, the engine cannot reach full rated rpm and top speed and pulling power will be reduced, or curb idle speed will be excessive.

6. **Air Cleaner Restriction:** A dirty air cleaner may result in low power, excessive smoke and poor fuel economy.

Engine Performance Diagnostic Procedure

7. **Fuel System Pressure and Capacity:** The fuel supply system must deliver the proper quantity of fuel with no pressure loss or air leaks in chassis fuel system.
8. **Engine Idle Speed:** Low engine idle speed may cause stalling or rough running.
9. **Fuel System Return Line Restriction:** A restriction in the fuel return line will raise the pressure in the injection pump causing an adverse effect on the injection pump timing, resulting in excessive smoke levels or loss of power.
10. **Constant Pressure Valve:** This valve provides a signal to the injection pump boost compensator. If the valve diaphragm is disconnected, worn, or damaged, it can result in loss of power or excessive smoke.
11. **Transfer Pump Pressure:** This is the pressure which is avaliable to charge the injection plunger. Low pressure will result in low power, and excessive smoke levels.
12. **Injection Timing:** Incorrect timing can be responsible for poor fuel economy, rough idling or hard starting and excessive smoke.
13. **Turbocharger Boost Pressure:** This is the pressure which is available to increase engine power output. Low turbocharger boost pressure or leakage in the pressure hoses will result in loss of engine power.
14. **Injection Nozzle Test:** The injection nozzles must be removed from the engine for this test. This is a functional test of injection nozzle performance. Incorrect nozzle performance will cause misses, poor fuel economy, loss of power and excessive smoke.
15. **Crankcase Pressure:** This test measures the amount of crankcase blow-by. More blow-by will create higher pressures. Crankcase pressure readings, plus rate of oil consumption, should be used to evaluate engine mechanical condition.

To perform the Engine Performance Diagnostic Procedure it will be necessary to connect the Pressure Test Kit, Rotunda 014-00702 with Pressure Test Kit Adapter Set, 014-00728 or equivalent, to the various components as shown in Figure 23.

NOTE: If the problem is hard starting, follow the procedures for troubleshooting the glow plug system prior to troubleshooting the fuel system.

Engine Performance Diagnostic Procedure

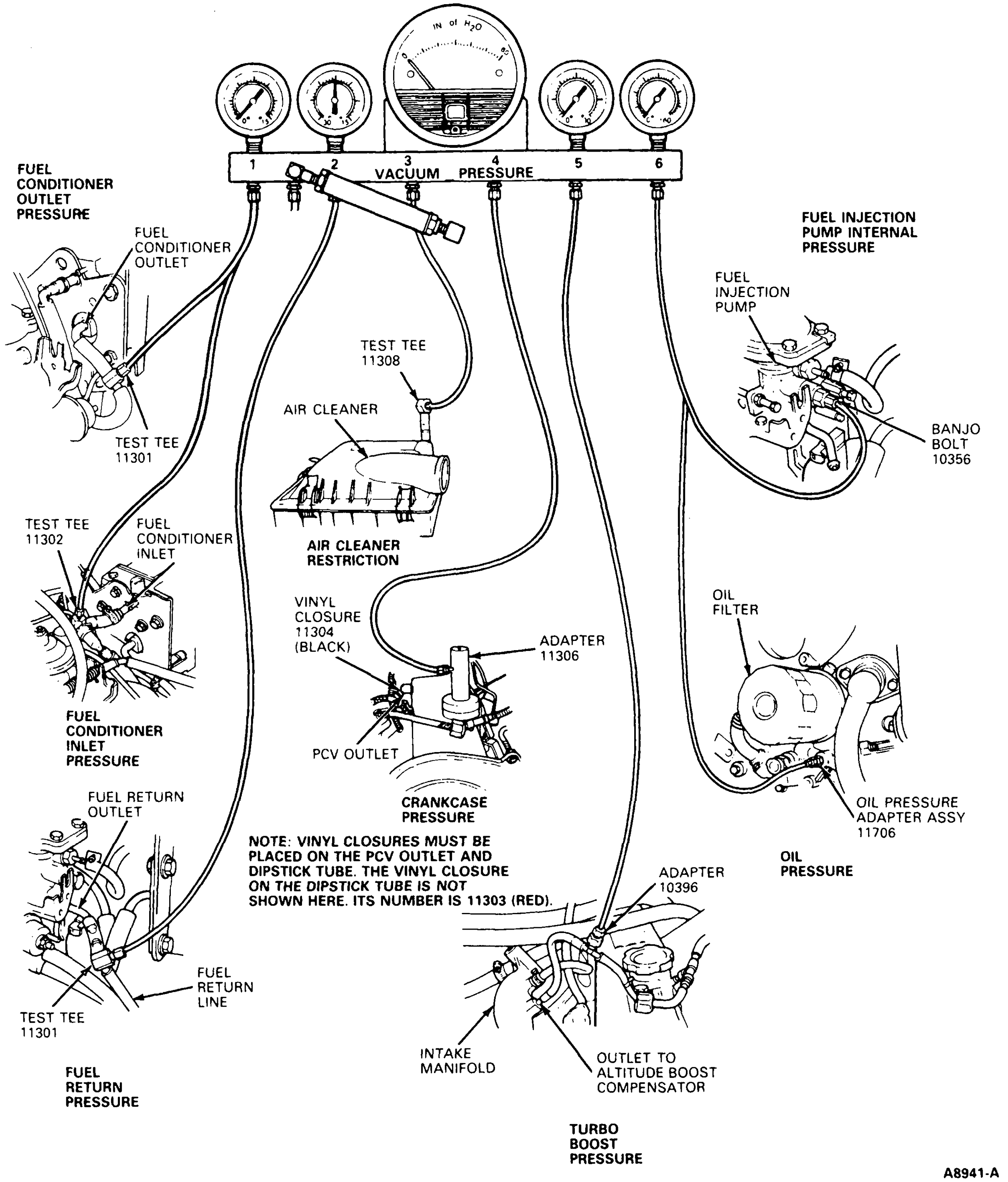
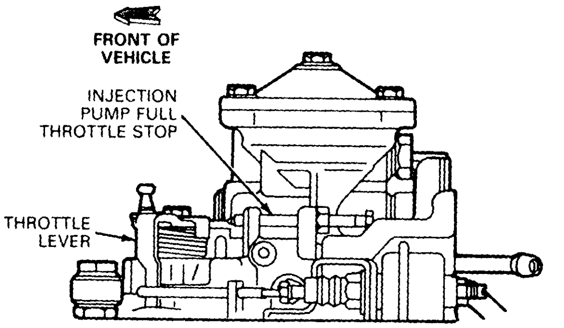


Figure 23 Pressure Test Kit Hookup

Engine Performance

TEST STEP	RESULT ►	ACTION TO TAKE
EPC.1 CHECK FOR EXTERNAL LEAKAGE **NOTE: Unless otherwise specified, all tests are to be performed with transmission in NEUTRAL with parking brake set.** - With engine running, visually check for leakage of: 1. Fuel 2. Engine oil 3. Proper installation and dirt past air cleaner 4. Coolant	No leakage ►	GO to **EPC.2**.
	Leakage detected ►	SERVICE or REPLACE faulty component(s). If problem still exists, GO to **EPC.2**.
EPC.2 CHECK EXHAUST SYSTEM - Visually check exhaust system for dents or kinks which could cause restriction.	OK ►	GO to **EPC.3**.
	~~OK~~ ►	SERVICE or REPLACE exhaust system as required. REFER to Shop Manual Section 26-01. GO to **EPC.3**.
EPC.3 FUEL SYSTEM CONDITION - Inspect fuel supply and return lines and hoses for kinks and all connections for tightness.	OK ►	GO to **EPC.4A**.
	Kinked lines/hoses, and/or loose connections ►	SERVICE or REPLACE faulty component(s). If problem still exists, GO to **EPC.4A**.
EPC.4A CHECK FUEL FOR CONTAMINATION - Obtain a fuel sample and visually examine fuel in a clear container (including bottom of container), for particles, clouding, or liquid contamination, such as water.	OK ►	GO to **EPC.4B**.
	~~OK~~ ►	REPLACE fuel filter. CLEAN and/or SERVICE fuel system as required. REFER to Shop Manual Section 25-50. GO to **EPC.4B**.

Engine Performance

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.4B CHECK FUEL FOR CETANE VALUE		
○ Check cetane value of fuel sample taken in Test Step **EPC.4A** using Rotunda Cetane Tester 078-00121 or equivalent included with Dynamic Timing Meter 078-00200 or equivalent. ○ Cetane value should be minimum of 40.	More than 40 ▶	GO to **EPC.5**.
	Less than 40 ▶	Complete Tests EPC.5, 6 and 11. INFORM owner* to change fuel source. GO to **EPC.5**. ***NOTE: Do not replace fuel injection pump because of low cetane problem.**
EPC.5 ACCELERATOR LINKAGE ADJUSTMENT		
○ With engine off, check that throttle lever contacts injection pump stop at full accelerator pedal depression. Full throttle screw is not adjustable. Tampering may cause injection pump or engine damage.  FRONT OF VEHICLE INJECTION PUMP FULL THROTTLE STOP THROTTLE LEVER EPC.5	OK ▶	GO to **EPC.6**.
	~~OK~~ ▶	ADJUST or SERVICE vehicle throttle linkage as necessary. REFER to Shop Manual Section 25-60. GO to **EPC.6**.
EPC.6 CHECK AIR INTAKE RESTRICTION		
○ Remove hose on air cleaner crankcase breather port and install adapter 11308 and Pressure Test Kit 014-00702 or equivalent.	Less than 6.2kPa (25 inches) H_2O ▶	REMOVE adapter. INSTALL cap on air cleaner port. GO to **EPC.7**.
○ Run engine at 4,000 rpm, no load. ○ Record restriction reading. ○ Restriction should not exceed 6.2 kPa (25 inches) of H_2O.	6.2 kPa (25 inches) H_2O or more ▶	REPLACE filter element and CHECK intake system for blockage. REPEAT Test Step **EPC.6**.

Engine Performance

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.7A FUEL FILTER OUTLET PRESSURE		
• Install adapter 11301 with Pressure Test Kit 014-00702, or equivalent into fuel conditioner outlet hose. Refer to Figure 23. • Run engine at 4,000 rpm, with no load. • Record pressure reading. • Pressure should be minimum of 7 kPa (1 psi) at 4,000 rpm.	OK ▶ ~~OK~~ ▶	GO to **EPC.7C**. GO to **EPC.7B**.
EPC.7B FUEL SUPPLY PUMP OUTLET PRESSURE		
• Install adapter 11302 and Pressure Test Kit 014-00702, or equivalent into fuel conditioner inlet hose. Refer to Figure 23. • Run engine at 4,000 rpm, no load. • Record pressure reading. • Pressure should differ by less than 24 kPa (3.5 psi) at 4,000 rpm from pressure in EPC.7A.	OK ▶ ~~OK~~ ▶	GO to **EPC.7C**. REPLACE fuel filter and REPEAT Test Step **EPC.7A**.
EPC.7C FUEL PUMP CAPACITY		
• Position end of sample hose on adapter 11302 in a clear, one quart, graduated fuel container.	Pressure and volume OK ▶	GO to **EPC.8**.
• Turn ignition to RUN, but do not start engine. Open clamp on sample hose, allowing fuel to flow into fuel container, for 30 seconds.	Pressure OK Volume Not OK ▶	GO to **EPC.7D**.
• Record volume.	Volume OK Pressure Not OK ▶	REPLACE fuel supply pump and REPEAT Test Step **EPC.7A**.
• Volume should be a minimum of one pint in 30 seconds.	Pressure and volume Not OK ▶	GO to **EPC.7D**.
EPC.7D AUXILIARY FUEL SUPPLY		
• Disconnect fuel supply pump inlet hose and connect an auxiliary fuel supply to the inlet. Use an approved container and make sure hose clamps are air tight.	Pressure and volume OK ▶	GO to **EPC.7E**.
• Repeat Test Step **EPC.7A** and **EPC.7C**.	Pressure and volume Not OK ▶	REPLACE fuel supply pump and REPEAT Test Step **EPC.7A**.

Engine Performance

TEST STEP	RESULT ►	ACTION TO TAKE
EPC.7E CHECK RESTRICTION AT FUEL SUPPLY PUMP		
● Reconnect fuel return line removed in Test Step **EPC.7A**. ● Install adapter 11302 and Pressure Test Kit to fuel supply pump inlet. ● With rear wheels off the ground and transmission in NEUTRAL, run engine at 4,000 rpm. ● Record vacuum reading. ● Vacuum should be less than 20 kPa (6 inches Hg).	OK ►	GO to **EPC.7F**.
	~~OK~~ ►	SERVICE or REPLACE restricted chassis fuel line(s). REFER to Shop Manual Section 25-50. REPEAT Test Step **EPC.7A**.
EPC.7F CHECK FUEL SUPPLY LINES FOR LEAKS		
● Disconnect fuel supply hoses from supply pump and fuel tank(s). ● Plug one end of hose(s). ● Pressurize chassis fuel system to a maximum of 103 kPa (15 psi). ● Apply a solution of soapy water to all valves and connections.	Bubbles present ►	SERVICE or REPLACE fuel system components as necessary. REPEAT **EPC.7C**.
	Bubbles not present ►	CHECK hose ends for damage. CHECK fuel tank(s), pick up screen(s) for leaks or blockage. SERVICE or REPLACE as necessary. REPEAT **EPC.7C**.
EPC.8 CHECK ENGINE IDLE SPEED		
● Check engine idle speed as described under Adjustments. ● Bring engine up to normal operating temperature. ● Idle speed is measured with transmission in NEUTRAL. ● Idle speed is shown on Vehicle Emission Control Information decal (VECI).	OK ►	GO to **EPC.9**.
	~~OK~~ ►	ADJUST idle speed as outlined. GO to **EPC.9**.

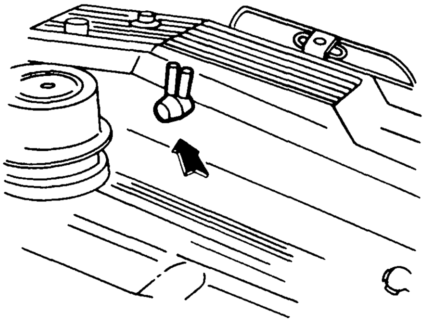
Engine Performance

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.9 CHECK FUEL RETURN PRESSURE • Remove fuel return line at fuel injection pump. • Install adapter 11301 and Pressure Test Kit 014-00702, or equivalent. • Run engine at 4,000 rpm, no load, transmission in NEUTRAL. • Record pressure reading. • Maximum pressure should not exceed 14 kPa (2 psi) at 4,000 rpm.	OK ▶	GO to **EPC.10**.
	~~OK~~ ▶	SERVICE or REPLACE fuel return line(s) as necessary. REFER to Shop Manual Section 25-50. REPEAT Test Step **EPC.9**.
EPC.10 CHECK CONSTANT PRESSURE VALVE (CPV) VACUUM • Disconnect vacuum hose at fitting on base of boost compensator. • Install adapter 10396 and Pressure Test Kit 014-00702 or equivalent. • Run engine at idle rpm, no load, transmission in NEUTRAL. • Record vacuum reading. • Vacuum should be 95 kPa (13.8 inches Hg), minus 5.8 kPa (0.84 inches Hg) per 1,000 feet in altitude above sea level.	OK ▶	GO to **EPC.11**.
	Vacuum is low ▶	CHECK vacuum pump operation. SERVICE or REPLACE as necessary. REPEAT **EPC.10**.
	Vacuum is high ▶	REPLACE constant pressure valve. REPEAT **EPC.10**.
EPC.11 CHECK INJECTION PUMP TRANSFER PRESSURE • Remove banjo fitting from injection pump fuel return line. • Install adapter 10356 and Pressure Test Kit 014-00702 or equivalent. • Run engine at 800 rpm, no load, with transmission in NEUTRAL. • Record pressure reading. • Run engine at 4,400 rpm, no load, with transmission in NEUTRAL. • Record pressure reading. • Pressure should be 186-276 kPa (27 to 40 psi) at 800 rpm. Pressure should be 627-717 kPa (91-104 psi) at 4,400 rpm.	OK ▶	GO to **EPC.12**.
	Readings low ▶	REPLACE injection pump. REFER to Shop Manual Section 22-10. If performance problem still exists after installing new pump, GO to **EPC.12**.
	Readings high ▶	SERVICE or REPLACE blocked fuel return line(s). REPEAT **EPC.11**.

Engine Performance

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.12 INJECTION PUMP TIMING		
o Check injection pump static timing as outlined under Adjustments.	OK ▶	GO to **EPC.13**.
	~~OK~~ ▶	ADJUST timing. If performance problem still exists after adjusting timing, GO to **EPC.13**.
EPC.13 CHECK TURBOCHARGER BOOST PRESSURE		
o Install adapter 10396 with Pressure Test Kit 014-00702 or equivalent, at fitting between intake and boost compensator. Refer to Figure 23. o Road test vehicle with an assistant to record gauge reading. o Measure boost at WOT in fourth gear from 1,500 rpm to 2,500 rpm. **Do not exceed the speed limit while performing this test.** o Boost should be more than 28 kPa (4 psi) at 1,500 rpm and 69 kPa (10 psi) at 2,500 rpm.	OK ▶	GO to **EPC.14**.
	~~OK~~ ▶	CHECK all boost hoses and intake for leaks. CHECK that waste gate is closed below 69 kPa (10 psi). REPLACE turbocharger, if noisy. If performance problem still exists, GO to **EPC.14**.
EPC.14 CHECK INJECTION NOZZLES AND INLET LINES		
o Check injection nozzle inlet lines for kinks or restriction. Refer to Shop Manual Section 22-10. o Remove injection nozzles. Refer to Shop Manual Section 22-10. o Test injection nozzles as described in this section.	Lines and nozzles OK ▶	GO to **EPC.15**.
	Lines and/or nozzles not OK ▶	REPLACE damaged injection nozzle fuel inlet lines. REFER to Shop Manual Section 22-10. CLEAN or REPLACE injection nozzles as described in this section and Shop Manual Section 22-10. If performance problem still exists, GO to **EPC.15**.

Engine Performance

TEST STEP	RESULT ►	ACTION TO TAKE
EPC.15 CHECK CRANKCASE PRESSURE		
• Install adapter 11306 and Pressure Test Kit 014-00702 or equivalent, at the oil fill opening in the valve cover. Refer to Figure 23. • Remove breather host at valve cover and cap fitting on valve cover using cap 11303 and clamp 11814 or equivalent.  EPC.15 • Run engine at idle and record crankcase pressure. • Crankcase pressure should be a maximum of 10 kPa (40 inches of H_2O) at idle.	OK ►	Fuel system is OK. Problem is result of other engine conditions.
	~~OK~~ ►	CHECK engine compression. REFER to Shop Manual Section 22-10.

Injection Nozzle Testing

Figure 24 shows the Rotunda Injection Nozzle Tester model 014-00300, used for this test.

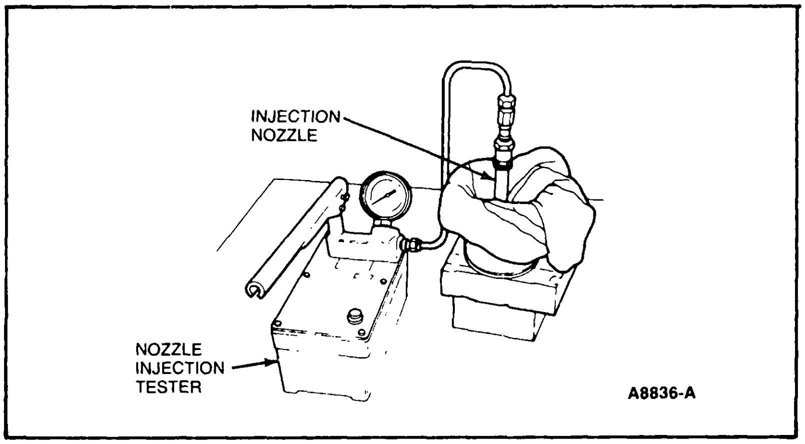


Figure 24 Injection Nozzle Tester

1. Prepare stand for making tests. Fill stand reservoir with clean calibration fluid. Open tester valve slightly and operate tester handle to expel air from tester and outlet pipe. Operate tester until solid fluid (without air bubbles) flows from end of outlet pipe. Close tester valve.
2. Connect injection nozzle to test stand. Care should be taken to avoid "cross-threading." Tighten connector nut securely with end wrench. The nozzle adapter which is supplied with tester has right hand thread to nozzle assembly and left hand thread to tester piping.
3. Bleed air from nozzle. Open stand valve and operate tester handle for several quick strokes to expel (bleed) air from injection nozzle. Fluid should spray from the spray holes in nozzle tip.

   WARNING: ALWAYS WEAR APPROVED SAFETY GLASSES WHEN OPERATING THE TESTER. VOLATILE LIQUIDS CAN BE EXTREMELY FLAMMABLE WHEN VAPORIZED. AVOID ANY CONDITIONS (SPARKS, OPEN FLAMES, LIT CIGARETTES, ETC.) WHICH MIGHT IGNITE THE FLUID USED DURING THE TEST PROCEDURE. THE ONLY LIQUID APPROVED FOR USE IN THIS TESTER IS SAE CALIBRATION NO. 208629, OR EQUIVALENT CALIBRATION FLUID (SAE J968D OR ISO 4113).

   WHEN A NOZZLE IS BEING TESTED OR IS IN OPERATION, KEEP HANDS AND OTHER PARTS OF THE BODY AWAY FROM THE SPRAYING NOZZLE. THE LIQUID SPRAY LEAVES THE NOZZLE TIP WITH SUFFICIENT FORCE TO PENERATE THE SKIN AND CAUSE SERIOUS INJURY. THE NOZZLE TIP SHOULD BE ENCLOSED IN A TRANSPARENT RECEPTACLE IF AVAILABLE.

4. Check nozzle opening pressure. Open gauge valve and build up line pressure by slowing depressing handle until nozzle opens (spray fuel). Observe gauge to determine pressure at which nozzle opens, then repeat operation until accurate opening pressure is established. Normal operating pressure of the nozzle is 11,770-12,750 kPa (1,707-1,849 psi).

   If opening pressure is not within specification, replace injector nozzle.

   NOTE: Chatter will vary from nozzle to nozzle as will the sound. While nozzle chatter is acceptable, a lack of chatter is not criteria for considering the nozzle to be defective.

Injection Nozzle Testing

5. Check the tip for leakage. Wipe nozzle tip dry. Operate test pump to maintain pressure at 9,800-10,790 kPa (1,420-1,560 psi). Nozzle tip should remain dry without an accumulation of fuel drops at spray holes. A slight wetting after about 5 seconds is permissible if no droplets are formed (Figure 25).
   NOTE: Do not wipe tip with fingers as this will tend to draw the fuel present in the sac hole through the orifice and falsely indicate a leak, causing rejection of a good nozzle.

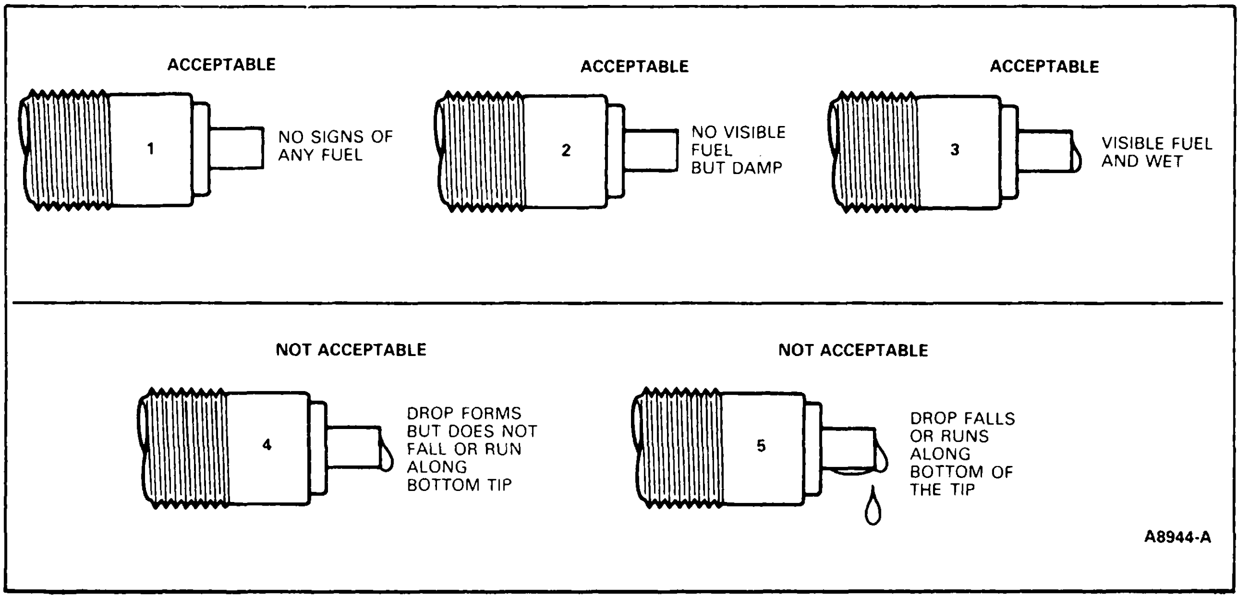


Figure 25 Tip Leakage Check

6. Check fuel leak-off. Operate test pump in quick strokes and observe flow of fluid from fuel return ports of nozzle. A very slight lead-off, one to two drops per stroke, is normal. If fluid squirts from fuel return port when test pump is operated, nozzle is faulty and must be replaced.

7. Check spray pattern. Operate test pump in smooth, even strokes and observe pattern of fluid spraying from nozzle tip. Only the first 76mm (3 inches) of spray from the end of the nozzle is important. The spray should be finely atomized in an even, straight pattern. The nozzle is defective if the spray pattern is lopsided (not concentric with nozzle axis) or uneven, or if fuel comes out in droplets or in a solid stream (Figure 26). If nozzle fails spray pattern test, clean nozzle as described in Step 8 and repeat test.

Injection Nozzle Testing

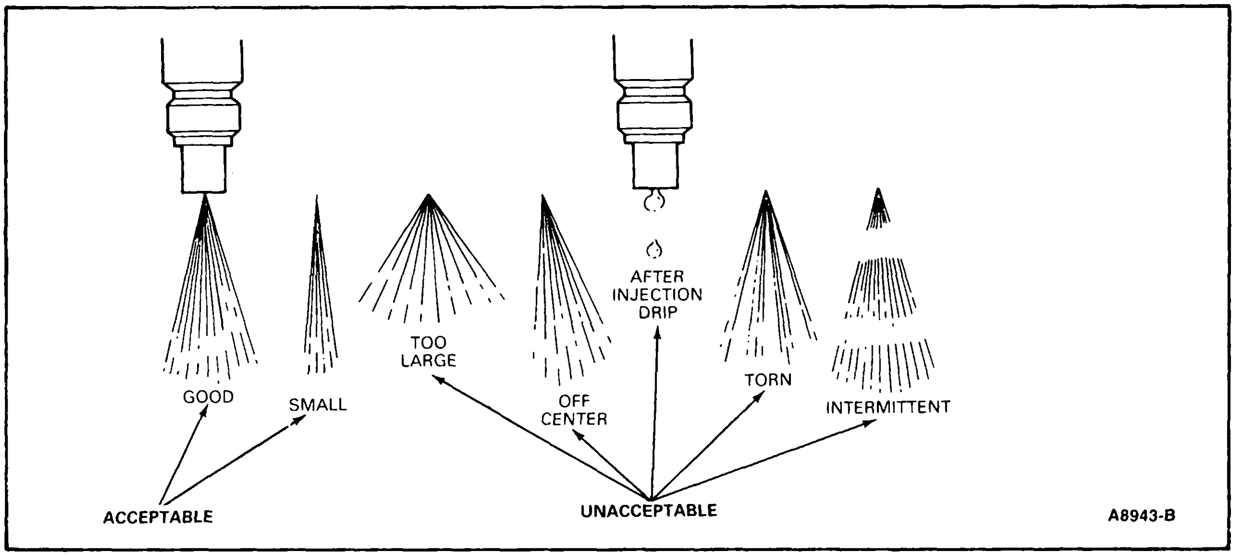


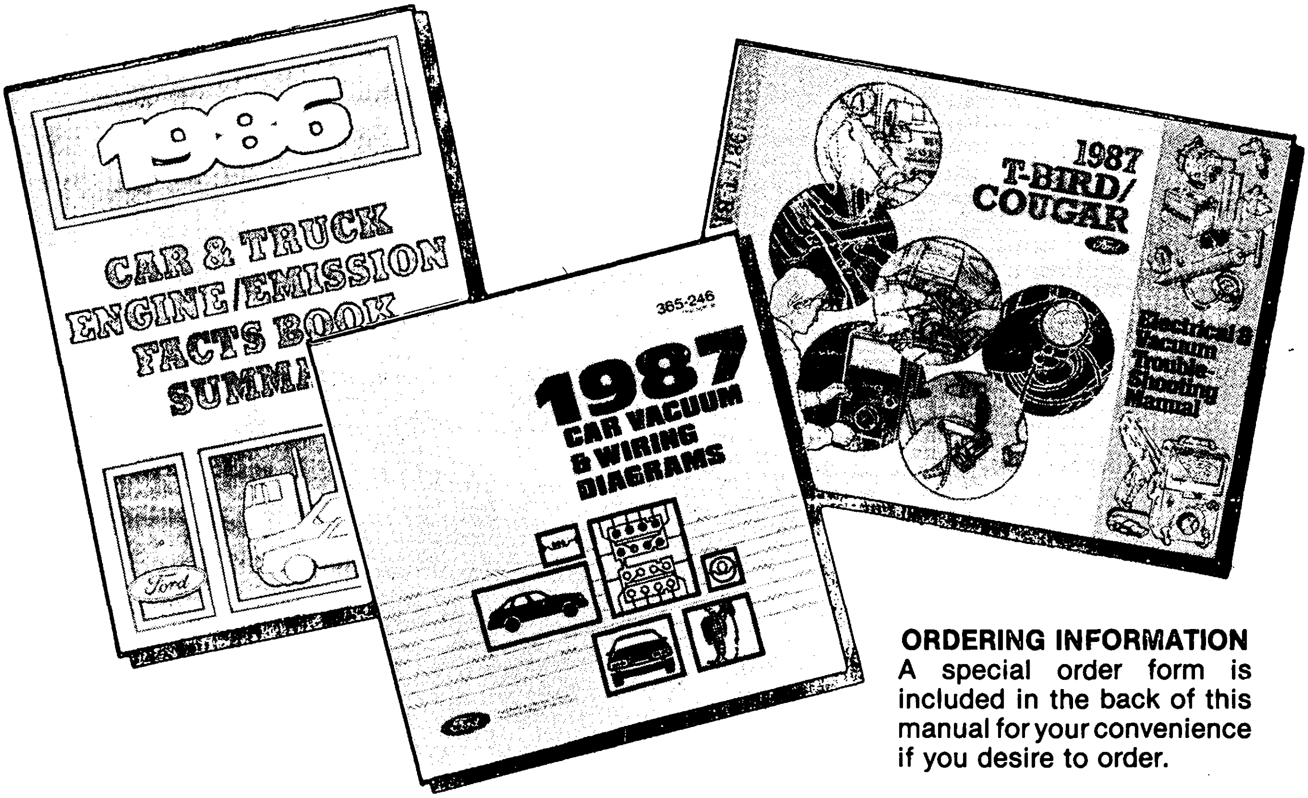
Figure 26 Injection Nozzle Spray Pattern

If nozzle passes the prior tests, it is suitable for further service in the engine following external cleaning and removal of accumulated carbon. Nozzles showing irregular spray pattern, leakage at nozzle tip spray holes, excessive fuel leak-off or opening pressure below minimum permissible limit should be replaced.

8. Clean nozzles. After testing, place nozzle(s) in a cold Rotunda Decarbonizing Solution or equivalent, for one hour, or clean with an appropriate sonic cleaner and cleaning fluid. After removing nozzle(s) from the solution, clean accumulated carbon with a brass wire brush and scrappers from Nozzle Cleaning Kit model 014-00301 or equivalent (Figure 9). With carbon removed, wash off the outside surfaces of the nozzle(s). Wash protective caps and reinstall on nozzle ends.

OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS


1986
CAR & TRUCK ENGINE/EMISSION FACTS BOOK SUMMA
Ford
365-246
1987 CAR VACUUM & WIRING DIAGRAMS
1987 T-BIRD/ COUGAR
Electrical & Vacuum Trouble-Shooting Manual

ORDERING INFORMATION
A special order form is included in the back of this manual for your convenience if you desire to order.

ENGINE EMISSIONS FACTS BOOK

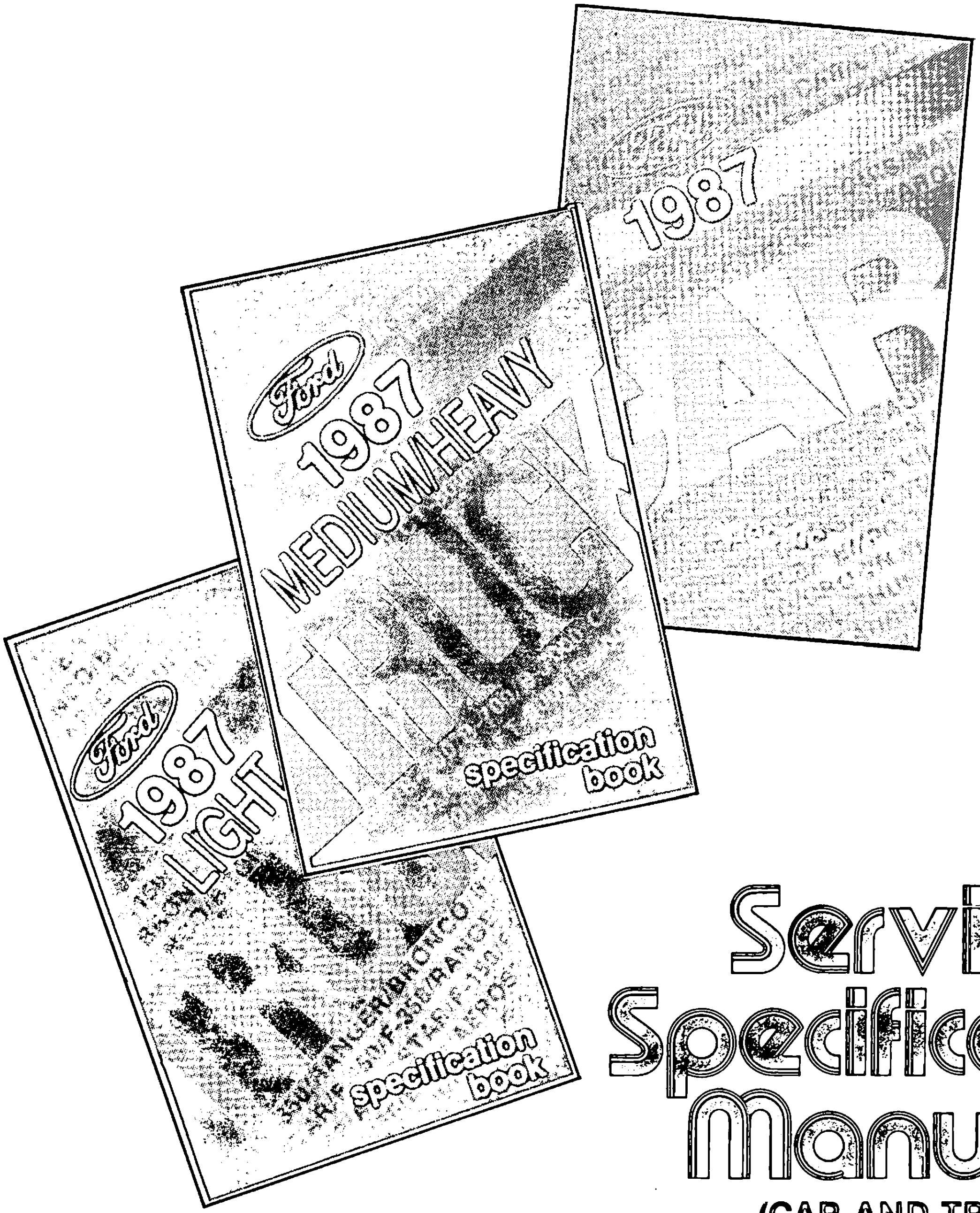
- The manual contains complete specifications for each calibration number.
- Published at the conclusion of the model year.

ELECTRICAL & VACUUM TROUBLESHOOTING MANUAL (EVTM)

- Available for all passenger car and light truck vehicles, this publication provides schematics of all electrical and vacuum circuits. Wiring diagrams show how the circuit is powered. Troubleshooting hints are provided to point the technician in a general direction but are not step by step procedures.
- Available in the first quarter of the model year. (One manual for each passenger car and light truck family.)

WIRING & VACUUM DIAGRAMS

- This publication contains wiring diagrams for all Ford and Lincoln/Mercury passenger car and light truck vehicles. A Power Distribution system illustrates the power distribution throughout each vehicle. In addition, all individual electrical circuits are shown for each vehicle line.
- Available in the first quarter of the model year.



Service Specifications Manuals

(CAR AND TRUCK)

- These manuals contain all specifications including maintenance and lubrication contained in the Shop Manuals in a handy pocket size for easy reference.
- Available in the first quarter of the model year.

SECTION 23

Diesel Diagnostics—6.6L and 7.8L Engines

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Preliminary Checkout

This Section covers Adjustments, Diagnosis, and Test procedures for the 6.6L and 7.8L diesel engines. The areas included are the low-pressure fuel system, high-pressure (fuel injection) fuel system, air induction system, turbocharger, lubrication and cooling systems.

Before Starting

Efficient diagnosis must take place in an organized manner with a plan or procedure which starts with the obvious and goes on to the more difficult. Eliminate all the obvious and easy-to-do items first. Do not start by jumping to conclusions. The job worked on last week might have been caused by an entirely different problem than the one today.

Get All The Information Available

Check out all sources of information. Talk to the operator. Sometimes asking a question will cause the operator to remember something that is useful.

The following list is a set of basic questions. Get the answers to these in order to learn what the true complaint is, and what the basic problem is.

Operating Conditions:

1. Did the problem occur suddenly or over a long period of time?
2. Were there any abnormal noises before the failure?
3. Was the engine under heavy or light load? Decelerating or accelerating?
4. Did the water temperature or oil pressure vary?
5. Were weather conditions a factor?
6. What type of road grade was the vehicle on when the trouble was first noticed?
7. How was the trouble first noticed (felt, heard, etc.)?
8. What was the amount of oil consumption? Fuel? Coolant? Had there been a recent change?
9. What was the exhaust smoke like? Light or dense? Color?
10. Does the engine have good throttle response?
11. Is deceleration normal?
12. Does the engine shut off properly?
13. Does the engine start correctly when cold?
14. Does the engine ever miss?
15. What kind of fuel is being used? Grade and source?
16. Does the engine surge at idle or wide-open throttle?
17. Is the engine subjected to periods of extended idling?
18. Has the vehicle or equipment been in an accident or collision?

Preliminary Checkout

Maintenance History:

1. Has the engine been serviced recently? What was done?
2. Has this complaint occured before? If so, what was done then?
3. When was the last tune-up?
4. When were the oil and fuel filters last changed?
5. Who normally performs the maintenance and adjustments?
6. Is the maintenance schedule followed closely?
7. How is fuel obtained and stored?
8. What type service designation (CC/CD), and what grade oil is used?
9. How many miles or hours has the engine operated since the last service?

Observed Information:

1. Is the engine clean or dirty?
2. Are the belts in good condition? Loose?
3. Is there evidence of external oil, coolant, or fuel leaks?
4. Does the engine appear to have overheated?
5. Are there any make-shift repairs on the engine (loose parts, wired-on parts, etc.)?
6. How does the engine sound at idle?
7. Are any pulleys wobbling?
8. Do any parts appear to have been altered or repaired recently?
9. Are there any aftermarket or unapproved parts on the engine?
10. Have any of the lines been altered or re-routed?
11. Are oil level, coolant level and fuel level satisfactory? (If the problem concerns bearings, notice the condition of the oil).
12. During disassembly, does the engine have unusual ordors, carbon accumulations, dirt or other conditions under the rocker cover?

Test Equipment

The following test equipment (Figures 1 through 4) is required for adjusting idle speed and timing.

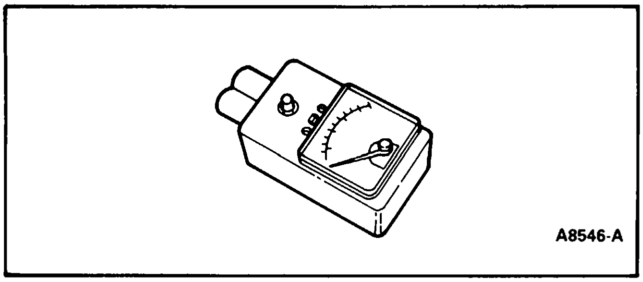


Figure 1 Photoelectric Tachometer, Rotunda 099-00001 Checking Engine

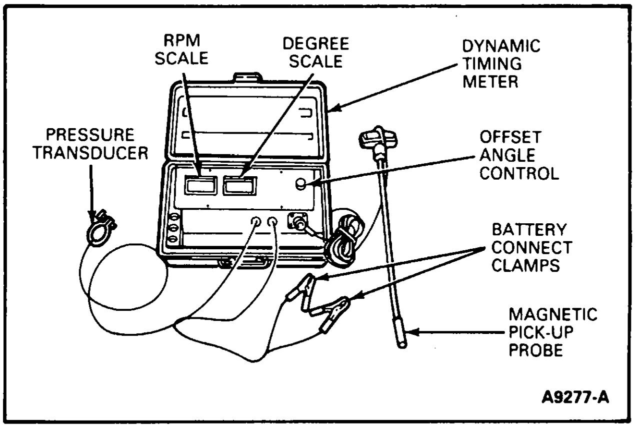


Figure 2 Dynamic Timing Meter, Rotunda 078-00100

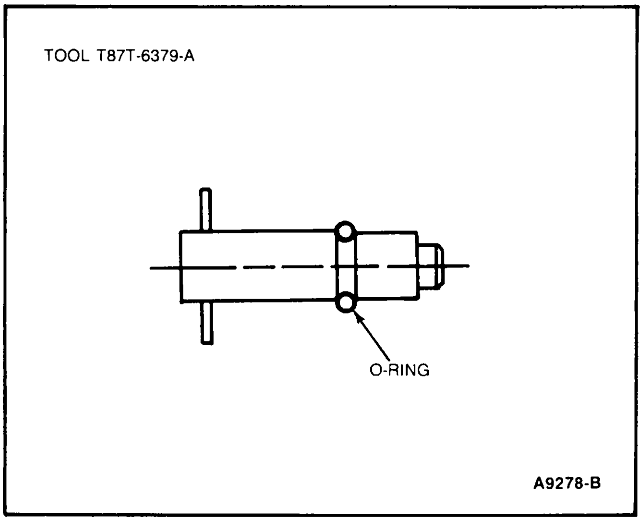


Figure 3 Timing Lock Pin—Damper T87T-6379-A

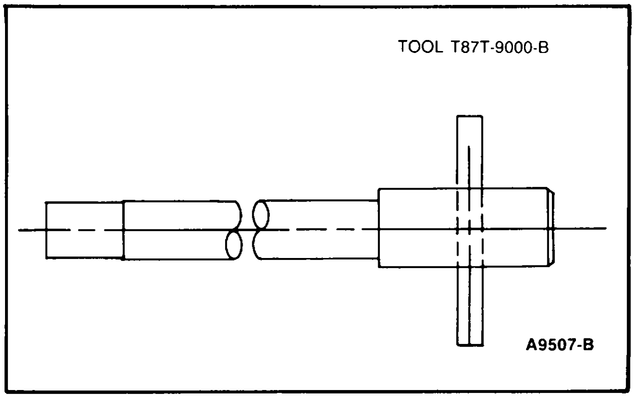


Figure 4 Timing Lock Pin—Injector Pump T87T-9000-B

Test Equipment

The following test equipment (Figures 5 and 6) is required for performing the Engine Performance Diagnostic procedure.

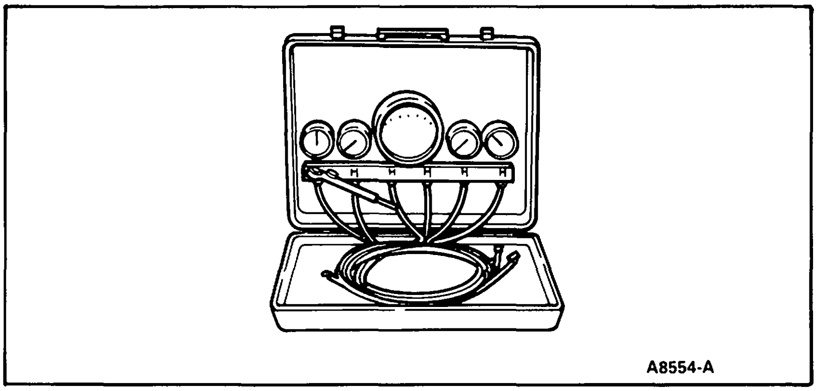


Figure 5 Rotunda 014-00702 Pressure Test Kit Used with Rotunda Adapter Kit 014-00733, 014-00734

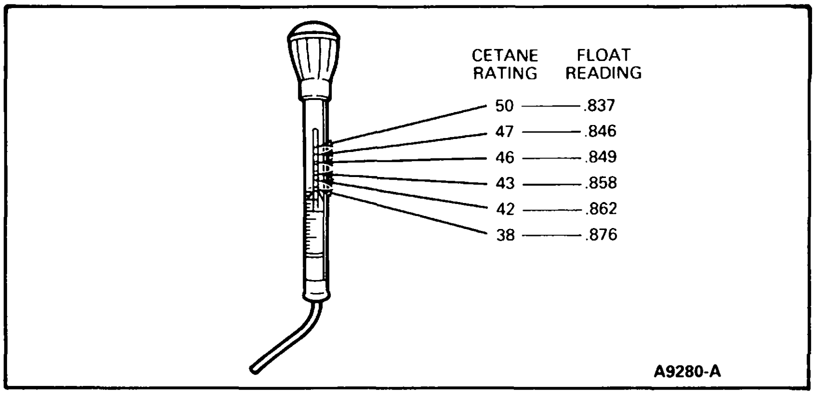


Figure 6 Fuel Quality (Cetane) Tester, Rotunda 078-00121

Test Equipment

The following test equipment (Figure 7) is used to test engine compression.

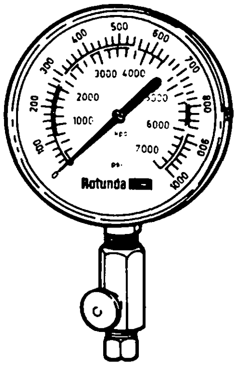


Figure 7 Rotunda Compression Tester 014-00701 Requires Adapter 014-00731

The following test equipment (Figure 8) is required for injection nozzle testing and cleaning.

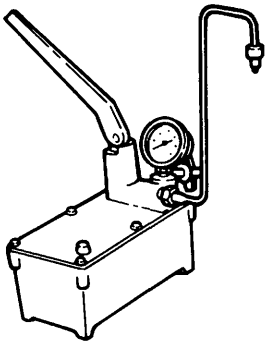


Figure 8 Rotunda Injector Nozzle Tester 014-00300 (Special Service Tool D83T-9000-F)

Engine Performance Specifications

		6.6L Turbo			7.8L Turbo			
		160	**170**	**170**	**185**	**210**	**225**	**240**
Engine Model		49	49	Calif.	49	49	Calif.	49
Engine Rating	(BHP @ 2400 rpm)						225	
	(BHP @ 2600 rpm)	160	170	170	185	210		240
Firing Order		1-5-3-6-2-4						
Injection Pump Make and Model	Robert Bosch	A-2000	P-3000	P-3000	P-3000	P-3000	P-3000	P-3000
Turbocharger Make and Model	Garret Airesearch	T04E						
Injection Nozzle Make		Robert Bosch						
Injection Nozzle Opening Pressure	PSI	3100-3220	3680-3800	3100-3220	3680-3800			
Minimum Allowable Opening Pressure (Service)	PSI	2870	3390	2870	3390			
Injection Pump Static Timing — BTDC		24°	19°	10°	18°	17°	11°	18°
Injection Pump Dynamic Timing — (No Load) @ 1000 rpm		24°	20°	10°	18°	18°	10°	18°
Low Idle Speed — Man. and Auto. Transmission		700-750						
High Idle Speed		2870-2950	2890-2960	2880-2990	2910-2990	2910-2990	2800-2880	2920-3000
Intake and Exhaust Valve Clearance (cold)	Intake	0.015 in (0.38mm)						
	Exhaust	0.018 in (0.46mm)						
Intake Manifold Pressure — Full Load @ 2600 rpm		18 ± 1 psi (124 ± 7 kPa)	15 ± 1 psi (103 ± 7 kPa)	21 ± 1 psi (145 ± 7 kPa)	15 ± 1 psi (103 ± 7 kPa)	20 ± 1 psi (138 ± 7 kPa)	16 ± 1 psi (110 ± 7 kPa) @ 2400 rpm	18 ± 1 psi (124 ± 7 kPa)
Crankcase Pressure (max allowable) @ 2600 rpm, no load		3 in H_2O (.7 kPa)					@ 2400 rpm	

CA9966-A

Engine Performance Specifications

	6.6L Turbo			7.8L Turbo			
	160	170	170	185	210	225	240
Fuel Pressure (filter inlet)	(Min) 15 psi (103.43 kPa) (Max) 28 psi (193.06 kPa)						
Fuel Pressure (filter outlet)	(Min) 15 psi (103.43 kPa) (Max) 30 psi (206.85 kPa)						
Pressure Drop Across Fuel Filter	(Max) 7 psi (48.27 kPa)						
Air Filter Restriction @ 2600 rpm, no load	(Max) 10 in H_2O (2.5 kPa)					@ 2400 rpm	
Lift Pump Suction @ 2600 rpm, no load	(Max) 10 in H_2O (2.5 kPa)						
Fuel Return Line Pressure — no load	(Max) 6 psi (41.37 kPa)						
Lubricating Oil Pressure at Operating Temperature	Low Idle: (Min) 15 psi (103 kPa)						
	High Idle: 65-95 psi (448-655 kPa)						

CA9967-A

Engine Lubrication System

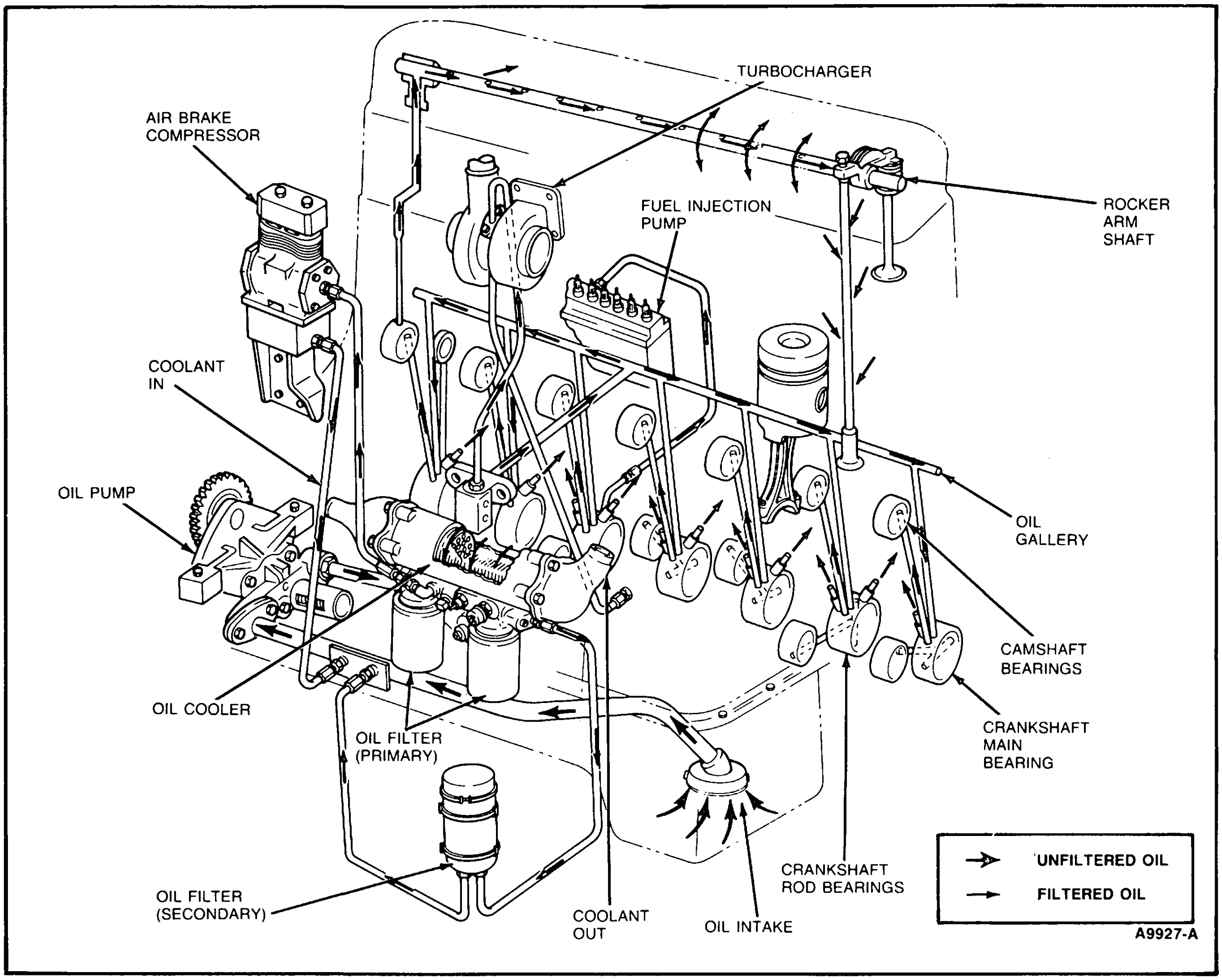


Figure 9 Phase 2 6.6L and 7.8L Lubrication System

Engine Lubrication System

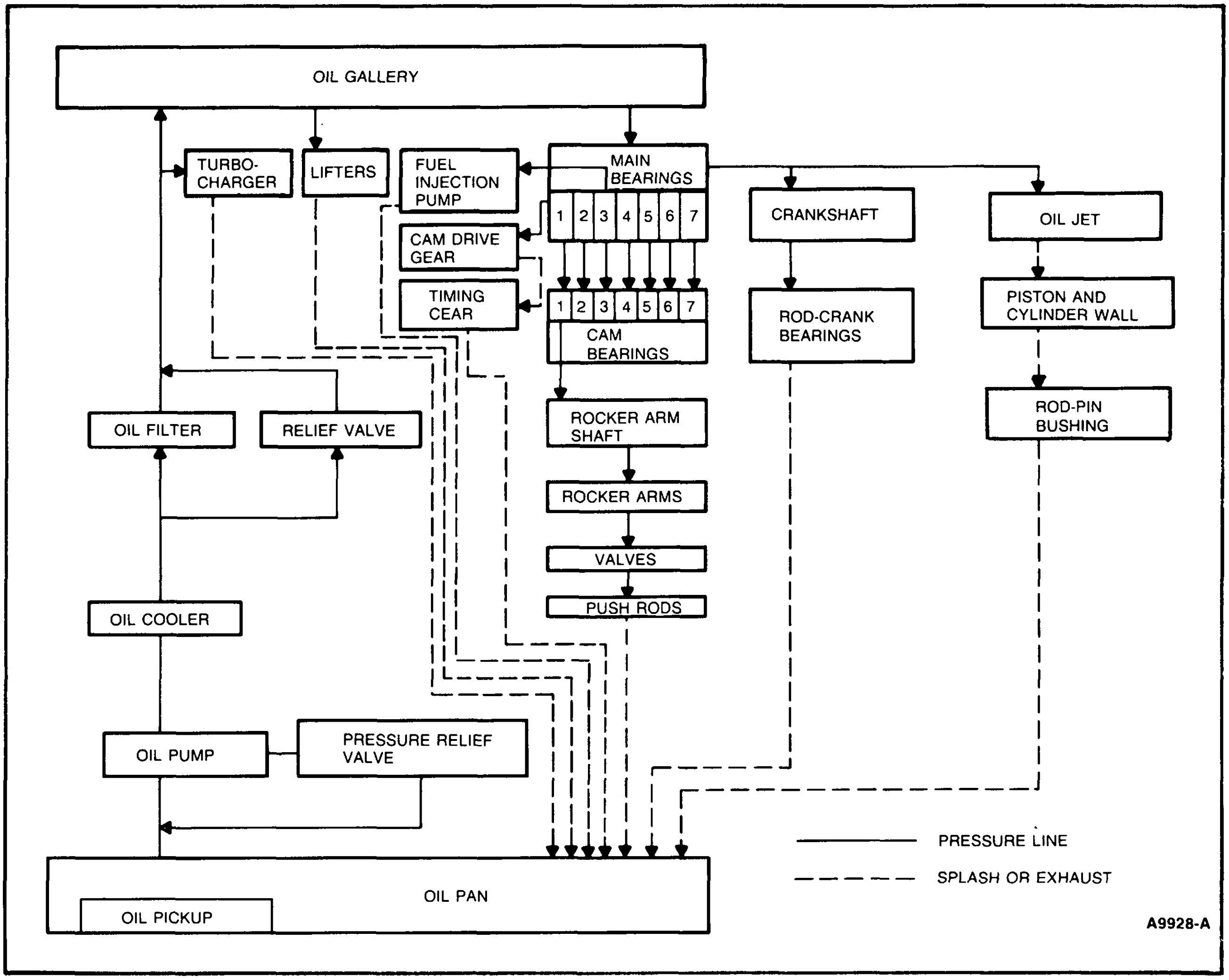


Figure 10 Phase 2 6.6L and 7.8L

High and Low Idle Speed Check and Adjustment

1. Clean crankshaft vibration damper and apply reflective tape at point shown in Figure 11.

NOTE: If dynamic timing meter is being used to check engine rpm, application of reflective tape on vibration damper is not necessary. Refer to Dynamic Timing for instructions on meter hookup.

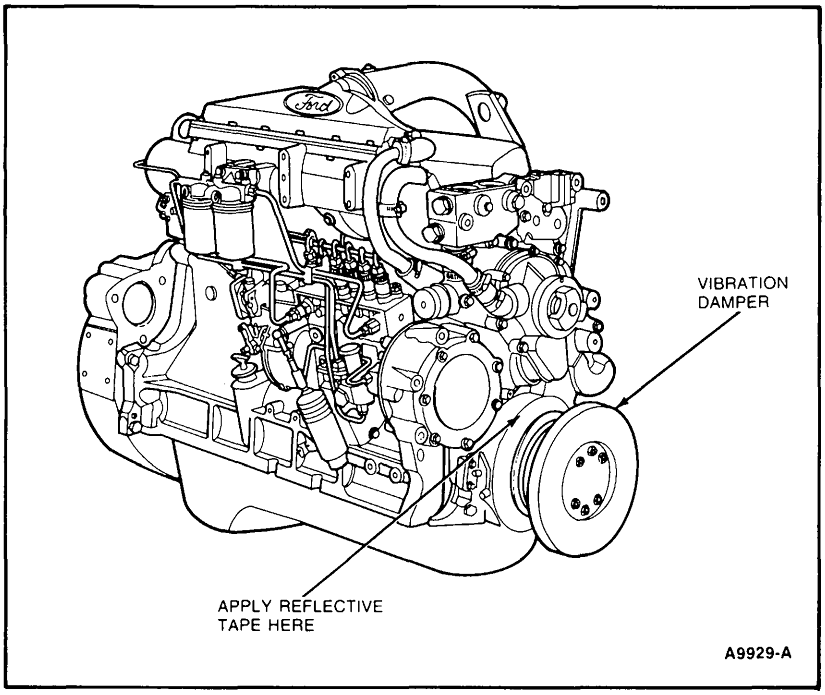


Figure 11 Reflective Tape Application

2. Place transmission in NEUTRAL or PARK and set the parking brake.
3. Bring engine to normal operating temperature. The engine must have been running at least 10 minutes prior to any adjustment.
4. Low idle speed is measured with manual transmission in NEUTRAL and automatic transmission in PARK.
5. Ensure that the throttle lever is against the low idle stop. If not, adjust linkage. Refer to Shop Manual Section 25-60.

High and Low Idle Speed Check and Adjustment

6. Check idle speed using Rotunda Photoelectric Tachometer 099-00001 or equivalent. Low idle speed is specified on the Vehicle Emission Control Information (VECI) decal. Turn adjusting screw (Figure 12) counterclockwise to increase speed, clockwise to decrease speed.

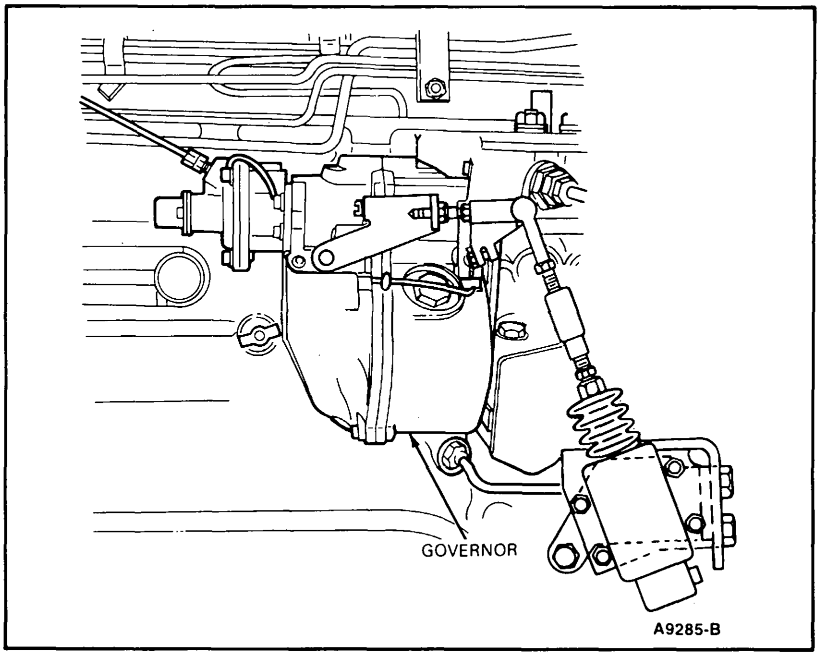


Figure 12 Adjusting Screw

7. Place transmission in NEUTRAL or PARK. Rev engine momentarily. Place transmission in specified gear (automatic transmission only) and recheck curb idle rpm. Adjust if necessary.
8. High idle speed is measured with manual transmission in NEUTRAL and automatic transmission in PARK or NEUTRAL.
9. Ensure that the throttle lever is against the high idle stop when the accelerator pedal is fully depressed. If not, adjust the linkage. Refer to Shop Manual, Section 25-60.
10. Check high idle speed using Rotunda Photoelectric Tachometer 099-00001 or equivalent.
11. If high idle speed is not correct, determine the problem. If the high idle is too low, go to the Engine Performance Diagnosis procedure. If the engine is overspeeding, the fuel injection pump should be sent to an authorized service center for inspection and diagnosis.

CAUTION: High idle speed is not to be adjusted. Breaking the seal on the high idle stop screw will void the warranty.

Dynamic Timing

Engine timing is verified by using the timing bracket (Figure 13) located beside the crankshaft damper. The timing bracket contains holes for checking dynamic timing and static timing. Positioning of the bracket is very important because if it is loosened or moved, timing will not be correct. The bracket is accurately positioned during production and chisel marked to the front cover during engine production. These chisel marks must always be aligned. The timing bracket should never be loosened or removed.

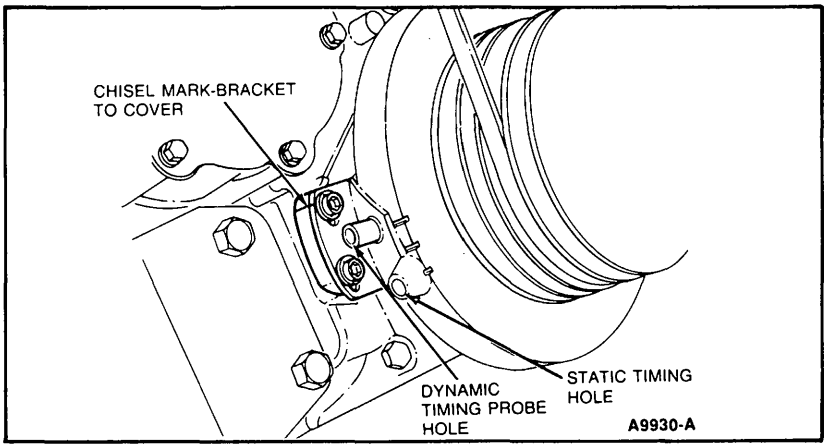


Figure 13 Timing Pin and Probe Bracket

Dynamic timing is used as a quick check for proper timing without going through the static timing procedure, using the timing lock pins. Do not under any circumstances change or set engine timing based only on dynamic timing readings. Timing is to be set only with the Timing Lock Pins T87T-9000-B and T87T-6379-A or equivalent.

1. With engine stopped, install Rotunda Dynamic Timing Meter 078-00100 or equivalent. Place the magnetic pickup into the timing bracket pointer hole (Figure 14). Attach the connector from the pickup to the meter lead.

   NOTE: To prevent incorrect readings, make sure that the vibration damper grooves are clean and free of debris and rust. The pickup groove in the damper must not be plugged, or readings will be inaccurate.

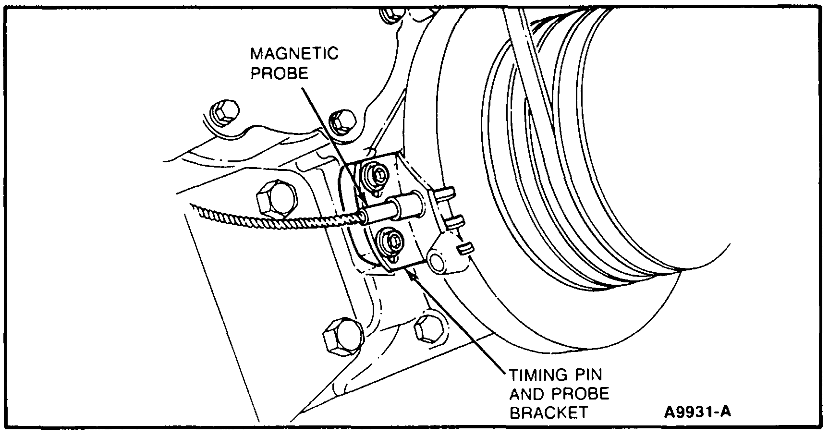


Figure 14 Inserting Magnetic Pickup Into Timing Bracket

Dynamic Timing

2. Attach the pressure transducer to the No. 1 injector line (Figure 15) at the injector. Be sure the injector line is clean and free of paint where transducer is attached. Tighten the thumbscrew on the transducer finger-tight when attaching to the injector line.

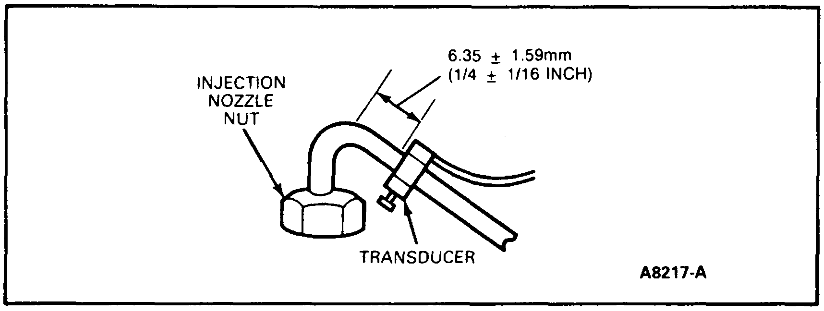


Figure 15 Pressure Transducer Attachment

NOTE: Cracks or other damage to the pressure transducer can cause incorrect timing readings. Follow these procedures carefully when working with pressure transducers.

- Do not over-tighten the transducer; snug fit is all that is needed. Do not use hand tool to tighten.
- Attach the transducer at the same location along the high-pressure line each time a check is made. The timing reading will change if the transducer is placed at a different location along the injector line.
- The transducer should be dry; wet conditions will give erratic readings. If erratic readings are observed, remove transducer, wipe line and transducer with a clean, dry cloth. Spray the transducer and line with a water-displacing material, and clamp on the injector line.

3. Connect the timing meter to the battery and adjust the offset angle on the meter to zero degrees.

CAUTION: Be sure that all wire leads are located away from the front accessory drive belts and cooling fan.

4. With the transmission in NEUTRAL or PARK and the parking brake set, start the engine. Set the engine speed at 1000 rpm with no load, and observe the timing meter.
5. Check the Engine Performance Specifications for the correct timing specification for the engine being serviced and compare with observed reading.
6. Turn the engine off and remove the dynamic timing components.
7. If timing is off more than 2 degrees and there are indications of incorrect timing, such as poor performance or smoke, check the static timing using the lock pins. If the engine is performing normally and there is no evidence of excessive smoke or poor performance, check all meter connections, and if necessary have meter calibration verified.

Static Timing

Pump On Engine (Check Timing)

1. Rotate engine clockwise. Set engine at correct static timing angle with No. 1 piston on the compression stroke. Fit Timing Lock Pin T87T-6379-A through the timing bracket into the correct crankshaft damper groove (Figure 16).

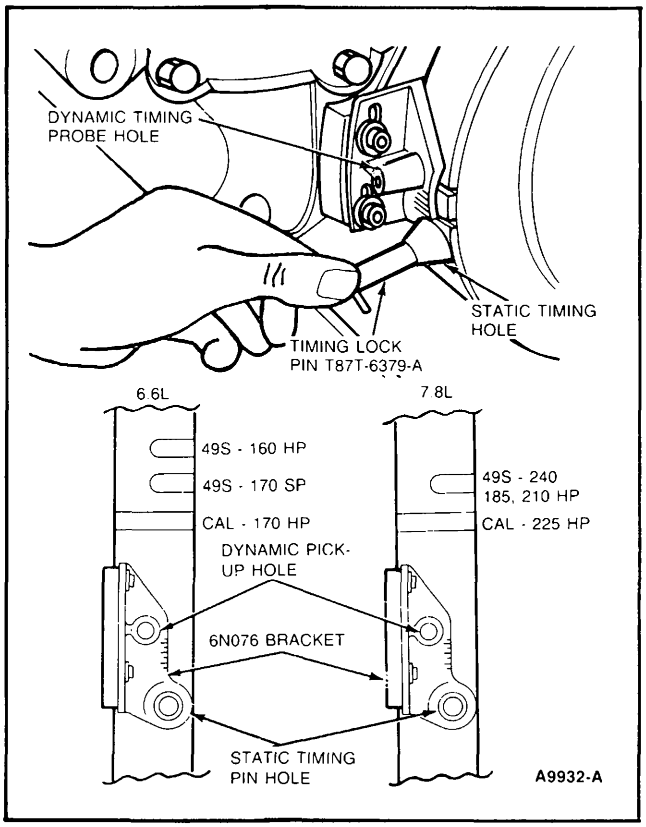


Figure 16 Fitting Timing Pin Into Crankshaft Damper

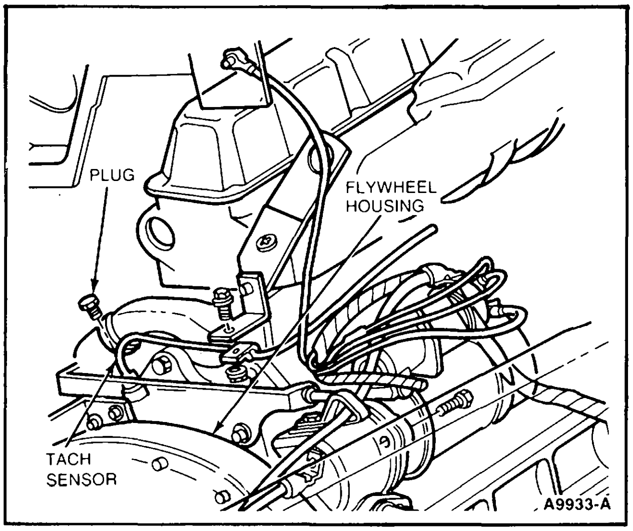


Figure 17 Tach Sensor or Plug Location

NOTE: The proper timing angle on the compression stroke of No. 1 cylinder is indicated by removing No. 1 injector and feeling for compression while turning the engine in the direction of rotation. When compression is felt, continue turning the engine until the alignment pin drops into the appropriate groove in the crankshaft damper cover. This indicates that the engine crankshaft is at the correct static timing angle with No. 1 piston on the compression stroke. Always approach the lock pin groove while turning the engine clockwise to assure that gear backlash will not affect timing.

NOTE: When unable to access front damper mounting bolt to rotate engine, remove plug or tach sensor at top of flywheel housing to rotate flywheel ring gear with large screwdriver.

CAUTION: Do not under any circumstances loosen or remove the timing bracket.

Static Timing

2. Remove the plug from the injector pump adapter plate timing pin location and install timing lock pin into the adapter plate (Figure 18).
3. It is important that the lock pin seats fully in the slot in the injection pump hub (to within 3mm (1/8 inch) of the shoulder of the lock pin) to shoulder of eccentric pin lock screw. This verifies proper engine timing. If the lock pin is not fully seated the timing will be incorrect.

CAUTION: Do not turn crankshaft with timing lock pins in place.

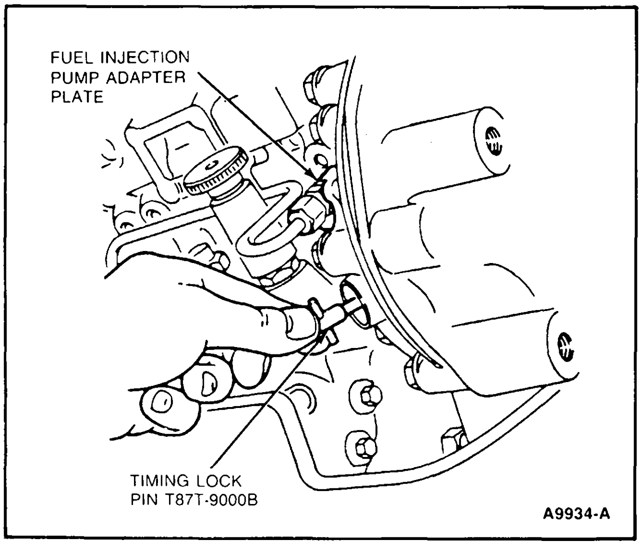


Figure 18 Lock Pin in Adapter Plate Installation

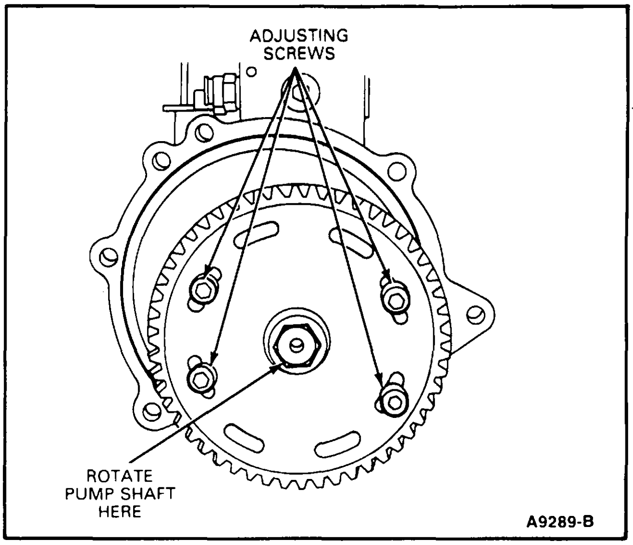


Figure 19 Injection Pump Gear Hub Adjusting Screws

NOTE: To properly adjust timing, be sure the damper timing pin is installed in the proper location with the No. 1 piston on the compression stroke.

4. To adjust timing, loosen the four adjusting screws on the injection pump gear hub (Figure 19), and rotate the pump shaft until the pump timing lock pin can be pushed into position and fully seated.
5. Turn gear counterclockwise by hand to remove backlash (it will move slightly). Tighten the four adjusting screws to 7 N·m (5 lb-ft). Remove the lock pins and tighten the adjusting screws to 22-26 N·m (16-19 lb-ft). Replace plug and sealing washer in adapter plate timing pin hole. Tighten to 9-12 N·m (7-9 lb-ft).
6. Rotate engine counterclockwise 90 degrees and then clockwise to the point where timing lock pin can be inserted in crankshaft damper. Insert timing lock pins into crankshaft damper and into fuel injection pump hub. If pin seats in injection pump gear hub, timing is correct. If it does not seat, repeat timing procedure.

Injection Pump Removed From Engine—Timing Bracket Removed or Loosened

1. Align timing bracket chisel mark with chisel mark on engine front cover. Tighten the timing bracket screw to 9-12 N·m (7-9 lb-ft).

NOTE: If a new timing bracket is being installed, it is necessary to accurately position the timing bracket with the damper timing groove. This requires a special procedure found in Shop Manual, Section 22-11.

Static Timing

2. Lock the fuel injection pump at port closure by inserting the lock pin into the fuel injection pump adapter housing so that it locks into the slot in the injection pump hub.
3. Set the engine, with No. 1 cylinder on the compression stroke, at static timing angle using the timing bracket and lock pin. Rotate the engine at least 20 degrees counterclockwise, then clockwise until the lock pin in the timing bracket engages the correct groove in the damper cover.
4. Loosen the four adjusting screws on injection pump gear hub.
5. Install the injection pump on the engine and align the adapter bolt holes to holes on engine. Install pump bolts and tighten to 27-34 N·m (20-25 lb-ft).
6. Rotate the pump gear counterclockwise to remove the pump gear backlash and tighten the four adjusting screws on the hub to 7 N·m (5 lb-ft). Remove the timing lock pin from the pump. Tighten the four adjusting bolts to 22-26 N·m (16-19 lb-ft). Install the lock pin hole plug to 9-12 N·m (7-9 lb-ft).
7. Install engine components and check dynamic timing as outlined.

Injection Pump Off Engine—Timing Bracket Undisturbed

- Perform Steps 2 through 7 of Static Timing: Injection Pump Off Engine—Timing Bracket Removed or Loosened.

Fuel System Description

Figure 20 shows the two sides of the fuel system. In the low-pressure side, fuel pressure does not normally rise above 206 kPa (30 psi). In the high-pressure side, fuel pressure can be over 68,950 kPa (10,000 psi).

In the low-pressure side, fuel is supplied to the injection pump by the lift pump. Fuel flows from the fuel tank to the fuel block, to the lift pump, through the dual filters to the injection pump.

In the high-pressure side, the injection pump plungers raise the pressure to over 68,950 kPa (10,000 psi) and distributes fuel to the injector nozzles by way of the high-pressure fuel lines.

Approximately 40% of the fuel reaching the fuel injection pump and injectors is used for combustion. The remaining fuel cools and lubricates the fuel injection pump and injectors and returns to the fuel tank through a fuel return line.

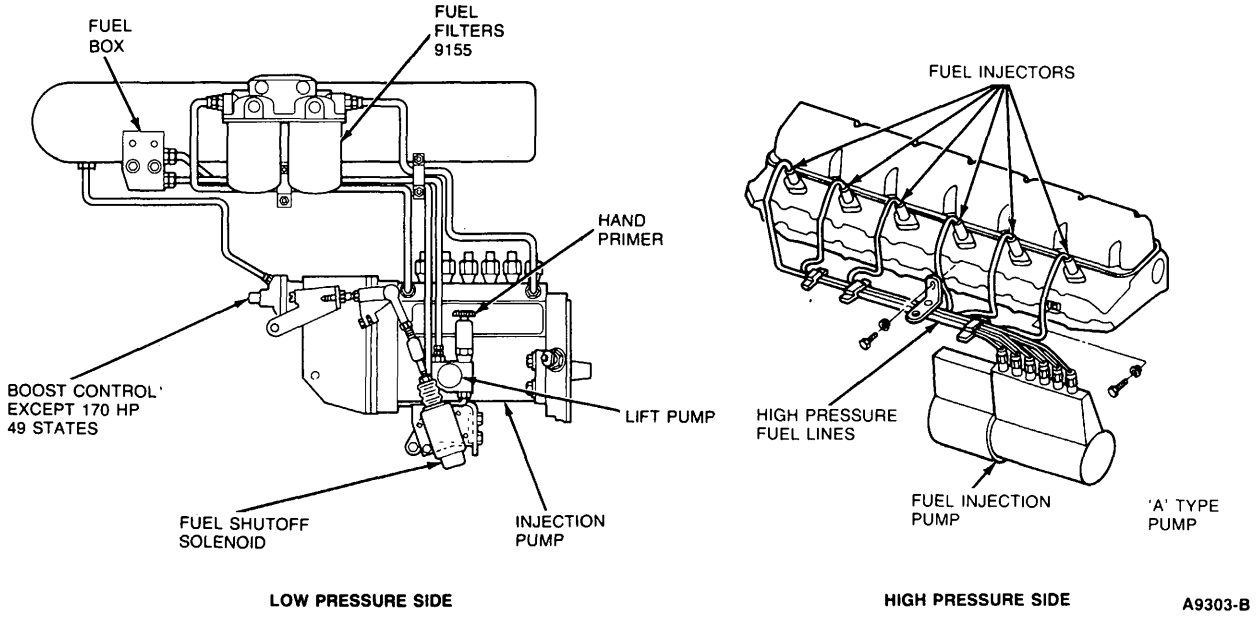


Figure 20 Typical 6.6L, 7.8L Diesel Engine Fuel System

Symptom Analysis

The Symptom Analysis Pinpoint Diagnosis procedures should be consulted first. These will direct you to a service to be performed or they will direct you to the Engine Performance Diagnosis procedure.

If the problem is low power and/or increased fuel consumption, go directly to the Engine Performance Diagnosis procedure.

Evaluating "Normal" Diesel Engine Exhaust Smoke

The following is a description of what is "normal" and expected exhaust smoke for a vehicle with a diesel engine. Diesel exhaust smoke can vary in color and consistency. The following chart should help in determining what causes certain types and colors of exhaust smoke and what should be done. Normal diesel exhaust smoke can be classified into two categories according to the color of the smoke.

The first category is blue-white smoke. Blue-white smoke may be observed at all ambient temperatures but should not occur after the vehicle is warmed and being driven. Blue-white smoke may occur after engine warm-up during extended idling due to the combustion chambers cooling down.

NOTE: Chassis fuel system air leaks also may cause continuous heavy blue-white smoke. Service fuel system as required.

The second category of diesel exhaust smoke is black smoke. Black smoke is caused by an over-rich mixture, and normally occurs whenever the engine is working hard. The engine works hard when it is going up a steep grade, carrying a heavy load, or during heavy acceleration. More black smoke will be observed when operating the vehicle at higher altitudes because the air is thinner. If black smoke is observed while the engine is idling (at low altitude) or under normal driving conditions, the problem should be diagnosed as soon as possible.

There is a third category of diesel exhaust smoke which is not normal, and that is blue smoke. Blue smoke occurs when oil is entering the combustion chamber and is burning along with the fuel. Smoke of this color usually indicates a definite problem which should be corrected as soon as possible.

Symptoms Analysis

Hard Starting/No Start	Pinpoint Test A
Engine Surges	Pinpoint Test B
Engine Misses	Pinpoint Test C
Excessive Black Smoke	Pinpoint Test D
Fog-Like Exhaust (White or Blue) in Full-Load Range	Pinpoint Test E
Engine Cannot Reach Governed rpm	Pinpoint Test F
Engine Knocks	Pinpoint Test G
Turbocharger Noisy	Pinpoint Test H
Cyclic Sound From Turbocharger	Pinpoint Test J
Oil Leak From Turbocharger Compressor or Turbine Seal	Pinpoint Test K
Low Oil Pressure with Proper Oil Level	Pinpoint Test L
Excessive Oil Consumption	Pinpoint Test M
Fuel Dilution in Lubricating Oil	Pinpoint Test M
Excessive Coolant Temperature-Temperature Above 105°C (220°F)	Pinpoint Test P
Fuel Injection Pump Overheating	Pinpoint Test Q

Hard Starting/No Start

Pinpoint Test **A**

TEST STEP	RESULT ►	ACTION TO TAKE
A0 CHECK STARTING PROCEDURE		
• Check and follow correct starting procedure.	OK ►	RETURN vehicle to customer.
	~~OK~~ ►	GO to A1.
A1 CHECK CRANKING SPEED		
• Check engine cranking rpm.	OK ►	GO to A2.
• Cranking speed should be a minimum of 110 rpm.	~~OK~~ ►	SERVICE cranking system. REFER to Shop Manual, Group 28.
A2 CHECK FUEL FLOW		
• Check for fuel in fuel tank.	OK ►	GO to A4.
• Loosen one injection line nut slightly while cranking engine. Fuel should discharge. **WARNING: BE EXTREMELY CAREFUL TO PREVENT BEING STRUCK BY DIESEL FUEL UNDER PRESSURE. DIESEL FUEL AT INJECTION PRESSURE CAN EASILY PIERCE THE SKIN, POSSIBLY CAUSING SEVERE SKIN POISONING. IF STRUCK BY DIESEL FUEL, SEEK MEDICAL HELP IMMEDIATELY.**	~~OK~~ ►	GO to A3.
A3 CHECK FUEL SHUTOFF SOLENOID		
• Check fuel shutoff solenoid linkage for binding.	OK ►	GO to A4.
• Check fuel solenoid shutoff electrical terminals for dirt or corrosion and loose or broken electrical connections.	~~OK~~ ►	SERVICE or REPLACE linkage or fuel shutoff solenoid. REFER to Shop Manual Section 25-02. REPEAT Step A2.
• With ignition in RUN position, measure voltage at fuel shutoff solenoid. Voltage should be a minimum of 9 volts.		

Hard Starting/No Start

Pinpoint Test **A**

TEST STEP	RESULT ►	ACTION TO TAKE
A4 CHECK STARTING AID		
- Check that starting aid is operating properly. Refer to Shop Manual Section 25-02.	OK ►	GO to Engine Performance Diagnosis procedure.
	~~OK~~ ►	SERVICE starting aid. REFER to Shop Manual Section 25-02. REPEAT Step **A4**. **NOTE: REVIEW proper cold-starting procedure with customer, if necessary.**

Engine Surges

Pinpoint Test **B**

TEST STEP	RESULT ►	ACTION TO TAKE
B0 CHECK FUEL TANK		
• Check to see if fuel tank is empty or if tank vent is blocked.	OK ►	GO to Engine Performance Diagnosis procedure.
	~~OK~~ ►	FILL fuel tank. BLEED air from fuel system. CHECK tank vent. REFER to Shop Manual Sections 25-02 and 25-50.

Engine Misses

Pinpoint Test **C**

TEST STEP	RESULT ►	ACTION TO TAKE
C0 ISOLATE MISS		
• Loosen each injector nozzle line nut (one at a time) while engine is running. Refer to On-Vehicle Injector Nozzle Testing. **WARNING: BE EXTREMELY CAREFUL TO PREVENT BEING STRUCK BY DIESEL FUEL UNDER PRESSURE. DIESEL FUEL AT INJECTION PRESSURE CAN EASILY PIERCE THE SKIN, POSSIBLY CAUSING SEVERE SKIN POISONING. IF STRUCK BY DIESEL FUEL, SEEK MEDICAL HELP IMMEDIATELY.**	Miss not isolated to specific cylinder ►	GO to Engine Performance Diagnosis procedure.
	Miss isolated to specific cylinder ►	GO to C1.
C1 CHECK NOZZLE FUEL DELIVERY		
• Check injector nozzle fuel line(s) for damage or restrictions. • Perform injector nozzle test as outlined under On Bench Injection Nozzle Testing.	OK ►	GO to C2.
	~~OK~~ ►	CLEAN or REPLACE restricted or damaged line(s). REFER to Shop Manual Section 25-02. REPLACE nozzle(s) as outlined under On Bench Injection Nozzle Testing.
C2 CYLINDER COMPRESSION CHECK		
• Perform cylinder compression test as outlined.	OK ►	GO to Engine Performance Diagnosis procedure.
	~~OK~~ ►	GO to C3.
C3 CHECK CRANKCASE PRESSURE		
• Perform Engine Performance Diagnosis procedure Test Step **EPC.11B.**	OK ►	SERVICE valve train as necessary. REFER to Shop Manual Section 22-11.
	~~OK~~ ►	OVERHAUL problem cylinder(s). REFER to Shop Manual Section 22-11.

Excessive Black Smoke

Pinpoint Test **D**

TEST STEP	RESULT ▶	ACTION TO TAKE
D0 VERIFY SMOKE LEVEL		
● Verify under what conditions black smoke occurs. **NOTE: Excessive black smoke may be accompanied by poor performance or low power.** **NOTE: Refer to Symptom Analysis.**	Light load or low altitude ▶	GO to D1 . **NOTE: For warranty claim approval, Engine Performance Chart must be filled out.**
	Under heavy load ▶	A certain amount of black smoke is normal when going up steep grades, under maximum load, maximum boost, maximum acceleration or at high altitude.
D1 EXHAUST RESTRICTION CHECK		
● Inspect exhaust system for kinks or restriction. ● Disconnect exhaust system at turbo and check performance.	OK ▶	GO to D2 .
	~~OK~~ ▶	SERVICE or REPLACE exhaust system components as necessary. REFER to Shop Manual Section 26-01.
D2 CHECK AIR INTAKE RESTRICTION		
● Perform Engine Performance Diagnosis Test Step **EPC.7.**	OK ▶	GO to D3 .
	~~OK~~ ▶	REPLACE air filter or other components as required.
D3 CHECK DYNAMIC TIMING		
● Check dynamic engine timing as outlined.	OK ▶	GO to D5 .
	~~OK~~ ▶	GO to D4 .

Excessive Black Smoke

Pinpoint Test

D

TEST STEP	RESULT ►	ACTION TO TAKE
D4 CHECK STATIC TIMING		
• Check static engine timing as outlined.	OK ►	Check dynamic timing meter for accuracy. If accurate, GO to Engine Performance Diagnosis Test Step **EPC.10.**
	~~OK~~ ►	Set static engine timing as outlined.
D5 CHECK NOZZLE FUEL DELIVERY		
• Check injector nozzle fuel line(s) for damage or restrictions. • Perform On-Vehicle Injector Nozzle test as outlined. **WARNING: BE EXTREMELY CAREFUL TO PREVENT BEING STRUCK BY DIESEL FUEL UNDER PRESSURE. DIESEL FUEL AT INJECTION PRESSURE CAN EASILY PIERCE THE SKIN, POSSIBLY CAUSING SEVERE SKIN POISONING. IF STRUCK BY DIESEL FUEL, SEEK MEDICAL HELP IMMEDIATELY.**	OK ►	GO to **EPC.11.**
	~~OK~~ ►	REPLACE restricted or damaged line(s). REFER to Shop Manual Section 25-02 or REPLACE nozzle(s) as outlined under On Bench Injection Nozzle Testing. If problem still exists, REPLACE the injection pump. REFER to Shop Manual Section 25-02. **NOTE: For warranty claim approval, Engine Performance chart must be filled out.**

Fog-Like Exhaust (White or Blue) In Full-Load Range

Pinpoint Test

E

TEST STEP	RESULT ▶	ACTION TO TAKE
E0 CHECK COOLING SYSTEM		
• Check to see that engine is reaching operating temperature.	OK ▶ ~~OK~~ ▶	GO to E2. GO to E1.
E1 THERMOSTAT OPERATION		
• Remove thermostats and test for proper operation. Refer to Shop Manual Section 22-11.	OK ▶ ~~OK~~ ▶	GO to E3. REPLACE thermostat(s). REFER to Shop Manual Section 22-11. REPEAT Step E0.
E2 EXCESSIVE OIL LEVEL		
• Check engine oil level indicator for excessive oil fill.	OK ▶ ~~OK~~ ▶	GO to E3. DRAIN excess oil from oil pan. If problem still exists, GO to E3.
E3 CHECK FUEL RETURN		
• Perform Engine Performance Diagnosis Test Step **EPC.8E.** **NOTE: If the fuel injection pump overflow valve is stuck shut, it will simulate a clogged fuel return line. To check this valve, measure inlet pressure to the injection pump. If the pressure exceeds 193 kPa (28 psi) at 2600 rpm the valve must be removed and cleaned or replaced. Refer to Shop Manual Section 25-02.**	OK ▶ ~~OK~~ ▶	PERFORM Engine Performance Diagnosis procedure. SERVICE or REPLACE fuel return line(s). REFER to Shop Manual Section 25-02. REPEAT Step E3.

Engine Cannot Reach Governed RPM

Pinpoint Test **F**

TEST STEP	RESULT ►	ACTION TO TAKE
F0 VEHICLE OVERLOADED		
• Check to see if vehicle is being overloaded (above specified GVW).	Vehicle is overloaded. ►	INFORM customer to reduce loads.
	Vehicle load normal ►	GO to $\boxed{F1}$.
F1 THROTTLE LINKAGE		
• Check throttle adjustment as outlined under Engine Performance Diagnosis Test Step **EPC.3.**	ⓄⓀ OK ►	PERFORM Engine Performance Diagnosis procedure.
	~~OK~~ ►	ADJUST the throttle adjustment. REFER to Shop Manual Section 25-60.

Engine Knocks

Pinpoint Test **G**

TEST STEP	RESULT ►	ACTION TO TAKE
G0 VEHICLE OVERLOADED		
• Check to see if vehicle is being overloaded (above specified GVW).	Vehicle is overloaded. ►	INFORM customer to reduce load.
	Vehicle load normal ►	GO to G1 .
G1 BELT DRIVE ACCESSORIES		
• Check engine front drive components for proper operation.	OK ►	GO to G2 .
	~~OK~~ ►	SERVICE or REPLACE components as necessary. REFER to specific accessory Shop Manual Section.
G2 ENGINE COOLANT TEMPERATURE		
• Verify engine coolant temperature is below 105°C (220°F).	OK ►	GO to G3 .
	~~OK~~ ►	GO to Pinpoint Test **Q**.
G3 ISOLATE ENGINE KNOCK		
• Loosen each injector nozzle line nut (one at a time) while running engine.	Engine knock not isolated to specific cylinder ►	GO to Engine Performance Diagnosis procedure.
WARNING: BE EXTREMELY CAREFUL TO PREVENT BEING STRUCK BY DIESEL FUEL UNDER PRESSURE. DIESEL FUEL AT INJECTION PRESSURE CAN EASILY PIERCE THE SKIN, POSSIBLY CAUSING SEVERE SKIN POISONING. IF STRUCK BY DIESEL FUEL SPRAY, SEEK MEDICAL HELP IMMEDIATELY.	Engine knock isolated to specific cylinder(s) ►	GO to G4 .

Engine Knocks

Pinpoint Test **G**

TEST STEP	RESULT ▶	ACTION TO TAKE
G4 CHECK NOZZLE FUEL DELIVERY		
• Check injector nozzle fuel line(s) for damage or restrictions. • Perform injector nozzle test as outlined under On Bench Injector Nozzle Testing.	OK ▶	GO to Engine Performance Diagnosis procedure.
	~~OK~~ ▶	SERVICE or REPLACE restricted or damaged line(s). REFER to Shop Manual Section 25-02 or REPLACE nozzle(s) as outlined under On Bench Injector Nozzle Testing.

Turbocharger Noisy

Pinpoint Test **H**

TEST STEP	RESULT ▶	ACTION TO TAKE
H0 AIR INTAKE OBSTRUCTION		
⊝ Check for obstruction or restriction in: a. Duct between air cleaner and compressor inlet. b. Duct between the compressor outlet and intake manifold. c. Intake manifold.	OK ▶	GO to **H1**.
	~~OK~~ ▶	REMOVE obstruction or REPLACE damaged parts. REFER to Shop Manual Section 22-11.
H1 AIR INTAKE LEAKS		
⊝ Check for air leaks in: a. Duct between the air cleaner and compressor inlet. b. Duct between the compressor outlet and intake manifold. c. Intake manifold to engine connection.	OK ▶	GO to **H2**.
	~~OK~~ ▶	REPLACE seals or tighten fasteners. REFER to Shop Manual Section 22-11.
H2 EXHAUST SYSTEM RESTRICTION		
⊝ Check for restricted or damaged exhaust system.	OK ▶	GO to **H3**.
	~~OK~~ ▶	SERVICE or REPLACE exhaust system components. REFER to Shop Manual Section 26-01.
H3 EXHAUST GAS LEAK		
⊝ Check for exhaust gas leak at: a. Exhaust manifold-to-engine connection. b. Turbine inlet to exhaust manifold.	OK ▶	GO to **H4**.
	~~OK~~ ▶	REPLACE gaskets or TIGHTEN fasteners. REFER to Shop Manual Section 25-45.

Turbocharger Noisy

Pinpoint Test **H**

TEST STEP	RESULT ►	ACTION TO TAKE
H4 COMPRESSOR WHEEL		
● Check for dirt caked on turbocharger compressor wheel or obvious signs of foreign object ingestion. **NOTE: If there is damage to compressor wheel or turbine wheel, the turbocharger will have to be replaced.**	OK ►	GO to **H5**.
	~~OK~~ ►	CLEAN the compressor wheel with a non-caustic cleaner and soft brush. FIND and CORRECT source of unfiltered air. CHANGE engine oil and oil filter.
H5 TURBOCHARGER		
● Remove turbocharger from engine. Check turbocharger for damage. Perform failure analysis. Refer to Shop Manual Section 25-45.	OK ►	INSTALL turbocharger on engine. GO to Step **EPC.12.**
	~~OK~~ ►	REPLACE turbocharger. REFER to Shop Manual Section 25-45.

Turbocharger Noisy or Cyclic Sound From Turbocharger

Pinpoint Test **J**

TEST STEP	RESULT ▶	ACTION TO TAKE
J0 AIR INTAKE DUCT		
• Check for a restriction in air intake duct into turbo compressor inlet.	OK ▶	GO to J1.
	~~OK~~ ▶	REMOVE obstruction or REPLACE damaged parts. REFER to Shop Manual Section 25-41.
J1 COMPRESSOR WHEEL		
• Check for dirt caked on compressor wheel of turbocharger.	OK ▶	GO to Pinpoint Test Step H5.
	~~OK~~ ▶	CLEAN compressor wheel with a non-caustic cleaner and a soft brush. LOCATE and CORRECT source of unfiltered air. CHANGE engine oil and oil filter.

Oil Leak From Turbocharger Compressor Or Turbine Seal

Pinpoint Test **K**

TEST STEP	RESULT ▶	ACTION TO TAKE
K0 CHECK AIR INTAKE RESTRICTION		
• Perform Engine Performance Diagnosis Test Step **EPC.7.**	OK ▶	GO to K1.
	~~OK~~ ▶	REPLACE air filter or other components as needed. REFER to Shop Manual Section 25-41.
K1 EXHAUST SYSTEM RESTRICTION		
• Inspect exhaust system for kinks or restriction. • Disconnect the exhaust system at the turbo and check performance.	OK ▶	GO to K2.
	~~OK~~ ▶	SERVICE or REPLACE exhaust system components as necessary. REFER to Shop Manual Section 26-01.
K2 EXHAUST GAS LEAK		
• Check exhaust manifold-to-engine gaskets for leaks at ports.	OK ▶	GO to K3.
	~~OK~~ ▶	REPLACE exhaust manifold-to-engine gasket(s). REFER to Shop Manual Section 22-11.
K3 CHECK TURBINE INLET		
• Check turbine inlet-to-exhaust manifold gasket for leaks.	OK ▶	GO to K4.
	~~OK~~ ▶	REPLACE exhaust manifold-to-turbocharger gasket. REFER to Shop Manual Section 22-11.

Oil Leak From Turbocharger Compressor Or Turbine Seal

Pinpoint Test **K**

TEST STEP	RESULT ►	ACTION TO TAKE
K4 OIL DRAIN LINE OBSTRUCTION		
• Check oil drain line for restriction.	OK ►	GO to K5.
	~~OK~~ ►	SERVICE or REPLACE oil drain line. REFER to Shop Manual Section 25-45.
K5 CRANKCASE VENT OBSTRUCTION		
• Check crankcase vent tube for damage or restriction.	OK ►	GO to K6.
	~~OK~~ ►	SERVICE or REPLACE crankcase vent tube. REFER to Shop Manual Section 22-11.
K6 TURBOCHARGER CENTER HOUSING		
• Check turbocharger center housing for sludge or coke deposits.	OK ►	GO to K7.
	~~OK~~ ►	CHANGE engine oil and oil filter. REPLACE turbocharger, if necessary. REFER to Shop Manual Section 25-45.
K7 EXCESSIVE BLOW-BY		
• Perform Engine Performance Diagnosis procedure Test Step **EPC.11B.**	OK ►	GO to K8.
	~~OK~~ ►	SERVICE engine as required. REFER to Shop Manual Section 22-11.

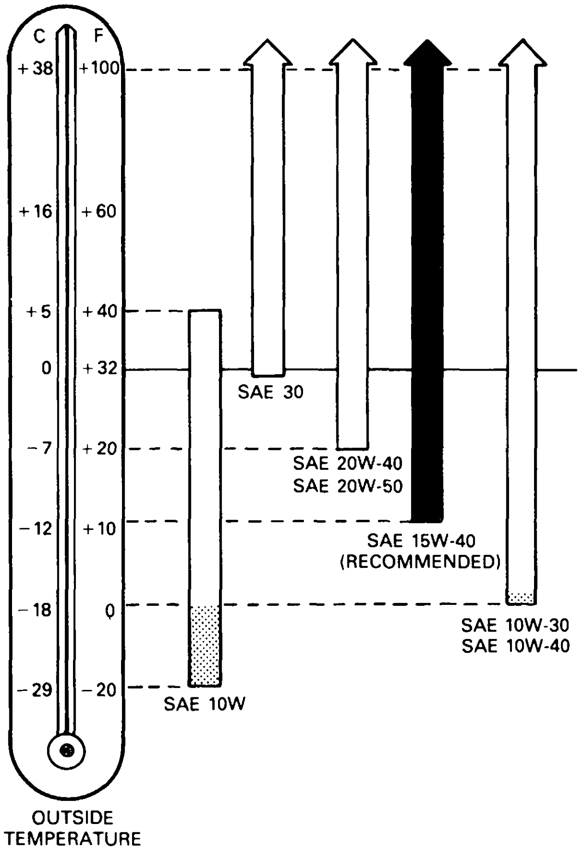
Oil Leak From Turbocharger Compressor Or Turbine Seal

Pinpoint Test **K**

TEST STEP	RESULT ►	ACTION TO TAKE
K8 INTERNAL ENGINE PROBLEM		
• Perform compression test as outlined.	OK ►	GO to K9.
	~~OK~~ ►	SERVICE engine as required. REFER to Shop Manual Section 22-11.
K9 COMPRESSOR WHEEL		
• Check for dirt caked on turbocharger compressor or turbine wheel for obvious signs of foreign object ingestion. **NOTE: If there is damage to compressor wheel or turbine wheel, the turbocharger will have to be replaced.**	OK ►	GO to K10.
	~~OK~~ ►	CLEAN compressor wheel with a non-caustic cleaner and soft brush. FIND and CORRECT source of unfiltered air. CHANGE engine oil and oil filter.
K10 TURBOCHARGER		
• Check turbocharger for damage. Perform failure analysis. Refer to Shop Manual Section 25-45.	OK ►	CHECK for oil leakage from other sources.
	~~OK~~ ►	REPLACE turbocharger. REFER to Shop Manual Section 25-45.

Low Oil Pressure With Proper Oil Level

Pinpoint Test **L**

TEST STEP		RESULT ▶	ACTION TO TAKE
L0	CHECK OIL PRESSURE		
	◎ Remove oil pressure sending unit. Connect Rotunda Pressure Test Kit 014-00702 or equivalent 11706 to engine. Refer to Pressure Test Kit Hook-up, Figure 18. ◎ Run engine until normal operating temp. is reached and check oil pressure. ◎ Engine oil pressure should be 103 kPa (15 psi) minimum at Low Idle — 448-665 kPa (65-95 psi) 6.6L and 7.8L at High Idle.	OK ▶ ~~OK~~ ▶	CHECK oil pressure gauge and/or sending unit. REFER to Shop Manual Section 33-32. INSTALL sending unit. GO to L1.
L1	CHANGE ENGINE OIL AND FILTER		
	◎ Change engine oil and filter. Use engine oil that meets API specification SF/CD (recommended), or CD. Determine viscosity according to ambient temperature:  ○ Run engine until normal operating temperature is reached. ◎ Check oil pressure reading.	OK ▶ ~~OK~~ ▶	RETURN vehicle to customer. GO to L2.

Low Oil Pressure With Proper Oil Level

Pinpoint Test **L**

TEST STEP	RESULT ▶	ACTION TO TAKE
L2 CHECK OIL PUMP DRIVE GEARS		
● Remove oil pan. ● Check oil pump drive gears for damage or wear. ● Check drive gear backlash. Refer to Shop Manual Section 22-11.	OK ▶	GO to L3.
	~~OK~~ ▶	REPLACE oil pump drive gears. REFER to Shop Manual Section 22-11.
L3 CHECK OIL PUMP INLET TUBE		
● Check oil pump inlet tubes for cracks. ● Check that oil pump inlet tube attaching bolts are tightened to specification. Refer to Shop Manual Section 22-11.	OK ▶	GO to L4.
	~~OK~~ ▶	REPLACE oil pump inlet tube or TIGHTEN attaching bolts to specification. REFER to Shop Manual Section 22-11. CHECK engine oil pressure.
L4 CHECK OIL PRESSURE TUBE		
● Check oil pressure tube for cracks. ● Check that oil pressure tube attaching bolts are tightened to specification. Refer to Shop Manual Section 22-11.	OK ▶	SERVICE or REPLACE oil pump assembly as necessary. REFER to Shop Manual Section 22-11.
	~~OK~~ ▶	REPLACE oil pressure tube or REPLACE oil pressure tube-to-engine block gasket and TIGHTEN attaching bolts to specification. REFER to Shop Manual Section 22-11.

Excessive Oil Consumption

Pinpoint Test **M**

TEST STEP	RESULT ▶	ACTION TO TAKE
M0 LEAK CHECK		
• Visually inspect for external oil leaks.	OK ▶	GO to M1.
	~~OK~~ ▶	SERVICE oil leaks. RETURN vehicle to customer.
M1 CHECK AIR INLET SYSTEM		
• Check for air cleaner restriction and check air induction system for leaks. Perform Engine Performance Diagnosis Test Step **EPC.11B.**	OK ▶	GO to M2.
	~~OK~~ ▶	SERVICE or REPLACE air inlet system components. REFER to Shop Manual Section 22-11.
M2 VERIFY PROBLEM		
• Change the oil. Use oil that meets API specification SF/CD (recommended), or CD. Determine viscosity according to ambient temperature as shown on chart in Pinpoint Test Step **L1.**		
• Determine oil consumption rate and trend at: 1610 km (1000 miles/50 hours) or 8047 km (5000 miles/250 hours)	Oil consumption less than 0.95L (1 quart) per 483 km (300 miles) ▶	RETURN vehicle to customer. Oil consumption is normal.
• Record amount of make-up oil added during test period.	Oil consumption more than 9.5L (1 quart) per 483 km (300 miles) ▶	GO to M3.
M3 CHECK VEHICLE LOAD		
• Determine if abnormally heavy loads are being pulled by vehicle (above specified GVW).	Vehicle load normal ▶	GO to M4.
	Vehicles overloaded ▶	INFORM customer to reduce loads.

Excessive Oil Consumption

Pinpoint Test

M

TEST STEP	RESULT ►	ACTION TO TAKE
M4 CHECK VEHICLE OPERATION		
• Check for improper operation (i.e., allowing engine to lug in incorrect gear range) resulting in oil consumption.	Truck being driven correct ►	GO to M5.
	Engine being lugged ►	INFORM customer to REVIEW operator habits to be sure engine is not being lugged.
M5 CHECK AIR CLEANER RESTRICTION		
• Perform Engine Performance Diagnosis Test Step **EPC.7.** Restriction should be less than 2.5 kPa (10 in) H_2O.	Air cleaner restriction within specification OK ►	GO to M6.
	Pulls over oil through turbocharger compressor seal ~~OK~~ ►	REPLACE element. REPEAT M5.
M6 CHECK CRANKCASE BREATHER/ ROADDRAFT TUBE		
• Check for restricted crankcase breather element or plugged crankcase roaddraft tube.	OK ►	GO to M7.
	~~OK~~ ►	SERVICE or REPLACE breather element or vent.
M7 CHECK AIR COMPRESSOR		
• Check air compressor for worn rings causing oil to leak into air system. Refer to Shop Manual Section 12-41.	OK ►	GO to M8.
	~~OK~~ ►	SERVICE or REPLACE air compressor. REFER to Shop Manual Section 12-41.

Excessive Oil Consumption

Pinpoint Test **M**

TEST STEP	RESULT ►	ACTION TO TAKE
M8 CHECK VALVE GUIDES/SEALS		
• Check for worn engine valve guide seals or valve guides. Refer to Shop Manual Section 22-11.	OK ►	GO to **M9**.
	~~OK~~ ►	CLEAN, INSPECT and REPLACE as necessary. REFER to Shop Manual Section 22-11.
M9 CHECK COMPRESSION		
• Perform engine compression test as outlined.	OK ►	RETURN vehicle to customer.
	~~OK~~ ►	SERVICE engine as necessary. REFER to Shop Manual Section 22-11.

Fuel Dilution in Lubricating Oil

Pinpoint Test **N**

TEST STEP	RESULT ►	ACTION TO TAKE
N0 VERIFY THE PROBLEM		
• Determine if there is fuel present in lubricating oil. **NOTE: If fuel is present, oil will have the odor of diesel fuel.**	No dilution ►	RETURN vehicle to customer.
	Fuel diluted ►	CHECK to see if vehicle has been idled for excessive periods. CHECK for internal fuel injection pump or injection nozzle leakage. REFER to Shop Manual Section 25-02.

Excessive Coolant Temperature
Temperature Above 105°C (220°F)

Pinpoint Test **P**

TEST STEP	RESULT ▶	ACTION TO TAKE
P0 VERIFY CONDITION		
- Determine conditions when overheating occurs.	Ambient temperature above 43°C (110°F) ▶	INFORM customer that condition is normal.
NOTE: Ambient temperatures above 43°C (110°F) may cause engine temperatures to exceed 105°C (220°F).	Ambient temperature below 43°C (100°F) ▶	GO to **P1**.
P1 VERIFY OPERATION		
- Check operator's driving habits (running in improper gear ranges, etc).	OK ▶	GO to **P2**.
	~~OK~~ ▶	INFORM customer to REVIEW operator driving habits.
P2 CHECK ACCESSORIES		
- Check that all accessory equipment is approved. - Check accessory drive belt tension. Refer to Shop Manual Section 27-06.	OK ▶	GO to **P3**.
	~~OK~~ ▶	ADJUST belt tension or REPLACE belts. INFORM customer accessories are not approved.
P3 CHECK ENGINE		
- Check that engine is clean. - Check for engine coolant and/or oil leaks.	OK ▶	GO to **P4**.
	~~OK~~ ▶	CLEAN engine. SERVICE engine coolant and/or oil leaks as necessary.

Excessive Coolant Temperature
Temperature Above 105°C (220°F)

Pinpoint Test **P**

TEST STEP	RESULT ►	ACTION TO TAKE
P4 CHECK ENGINE COOLANT		
• Check coolant condition. Refer to Shop Manual Section 27-02.	OK ►	GO to P5.
	~~OK~~ ►	DRAIN, FILL and BLEED the coolant system using the specified coolant and coolant conditioner. REFER to Shop Manual Section 27-02.
P5 CHECK RADIATOR, HOSES, CLAMPS		
• Check radiator cap for proper operation. • Check that correct hoses are installed and are properly clamped. • Check that radiator is correct for vehicle and is clean and unobstructed by bent fins, pinched tubes or foreign objects. • Check that correct fan is properly installed.	OK ►	GO to P6.
	~~OK~~ ►	SERVICE or REPLACE components as necessary. REFER to Shop Manual Group 27.
P6 CHECK WATER PUMP		
• Check water pump for worn bearings or coolant leaks.	OK ►	GO to P7.
	~~OK~~ ►	SERVICE or REPLACE water pump. REFER to Shop Manual Section 22-11.
P7 CHECK THERMOSTATS		
• Check thermostats for proper operation. Refer to Shop Manual Section 22-11.	OK ►	GO to P8.
	~~OK~~ ►	REPLACE thermostats. REFER to Shop Manual Section 22-11.

Excessive Coolant Temperature
Temperature Above 105°C (220°F)

Pinpoint Test **P**

TEST STEP	RESULT ►	ACTION TO TAKE
P8 CHECK STATIC TIMING		
- Check injection pump static timing as outlined.	OK ►	GO to **P9**.
	~~OK~~ ►	ADJUST static timing as outlined.
P9 CHECK FOR BLOWN HEAD GASKET		
- Fill a bucket and suitable bottle with water. - Run engine until normal operating temperature is reached. Stop engine. - Place filled bottle in bucket with neck facing down. - Insert coolant overflow hose into neck of bottle. - Start engine and look for air bubbles in bottle.	No bubbles present ►	RETURN vehicle to customer.
	Bubbles present ►	REPLACE blown head gasket. REFER to Shop Manual Section 22-11.

Fuel Injection Pump Overheating

Pinpoint Test

Q

TEST STEP	RESULT ►	ACTION TO TAKE
Q0 OVERFLOW VALVE		
- Verify that fuel flows freely from overflow valve.	OK ►	PERFORM Engine Performance Diagnosis Test Step **EPC.8E.**
	~~OK~~ ►	CLEAN orifice in overflow valve or REPLACE fitting. REFER to Shop Manual Section 25-02.

Engine Performance Diagnosis Procedure

The Engine Performance Diagnosis procedure begins with those items which are the high frequency, easy-to-diagnose problems, and progresses to the low frequency, hard-to-diagnose problems. Use of this procedure will promote rapid, as well as accurate diagnosis.

The Engine Performance Diagnosis procedure follows, step by step, the Engine Performance Chart. Each test step is labeled to coincide with the Engine Performance Chart steps.

NOTE: Under no circumstances should the fuel injection pump, fuel injectors or turbocharger be replaced until the Engine Performance Chart has been completely filled out. Warranty claims for the fuel injection pump, fuel injectors and turbocharger will not be accepted unless the Engine Performance Chart has been filled out as specified and all tamper-proof seals are intact.

Service each problem detected before going on the next step. If service corrects the original complaint, it will not be necessary to proceed to the next test step. However, if the complaint is not corrected, continue with the procedure until the complaint is corrected.

The following explanations refer to the basic test steps of the Engine Performance Diagnosis procedure and Chart. They give a brief description of the effect on performance these problems can create, giving an understanding of the importance of each test step.

1. **External Leakage:** Fuel leakage can be a reason for diesel fuel smell, poor fuel economy or poor performance. Oil leakage can be a reason for high oil consumption. An air intake system leak can shorten engine and turbocharger life, especially under dusty conditions. Coolant leakage can result in engine overheating. Exhaust gas or boost air leakage can cause poor engine performance and black smoke.

2. **Exhaust System Condition:** Kinks or dents in the exhaust system can cause high exhaust back pressure. This can result in loss of power and high smoke levels.

3. **Accelerator Linkage:** If the accelerator linkage is improperly adjusted, damaged or worn, low idle speed will not be out of specification or the engine cannot reach high idle and top speed, causing pulling power to be reduced.

4. **Fuel System Condition:** Kinks in the fuel lines or hoses can block or restrict fuel flow and loose connections can leak air into the fuel. This can result in loss of power, high smoke levels, and failure to start.

5. **Fuel Quality:** Diesel engines need clean fuel, free of air, dirt, water and microbiological organisms. Any contamination may result in poor engine performance.

   NOTE: If the fuel is contaminated with water, microbiological organisms are able to grow in a diesel fuel tank, especially in warm, moist climates. Therefore, it is very important to keep water from getting into the fuel.

   The diesel fuel recommended for use in the 6.6L and 7.8L diesel engines must be either grade 1-D or 2-D. Use No. 2-D fuel when ambient temperatures are above -7°C (20°F). Use No. 1-D when ambient temperatures are below -7°C (20°F). If No. 1-D is not available, use winterized 2-D. Use of regular No. 2-D during cold weather may cause starting and/or driveability problems due to reduced fuel flow caused by fuel waxing.

   The use of high sulfur fuel should be avoided. When fuel sulfur content exceeds 0.5 percent by weight, oil change intervals should be shortened. Consult the maintenance schedule for the required intervals.

6. **Engine Idle Speed:** Low engine idle speed may cause stalling or rough running.

Engine Performance Diagnosis Procedure

7. **Air Cleaner Restriction:** A dirty air filter or restriction in the air cleaner may result in low power, excessive smoke, poor fuel economy and oil leakage from the turbocharger.

8. **Fuel System Pressure and Capacity:** The fuel supply system must deliver the proper quantity of fuel with no pressure loss or air leaks in the chassis fuel system and then return unused fuel to the fuel tank. Restriction in the lines providing fuel to the fuel injection pump will result in low power, smoke problems and generally poor performance. Restrictions in the lines returning fuel to the fuel tank may cause problems of injection pump overheating, smoke problems and generally poor performance.

9. **Injection Timing:** Incorrect timing can be responsible for poor fuel economy, rough idling, hard starting and excessive smoke. Injection timing can be checked either statically or dynamically but can only be set statically.

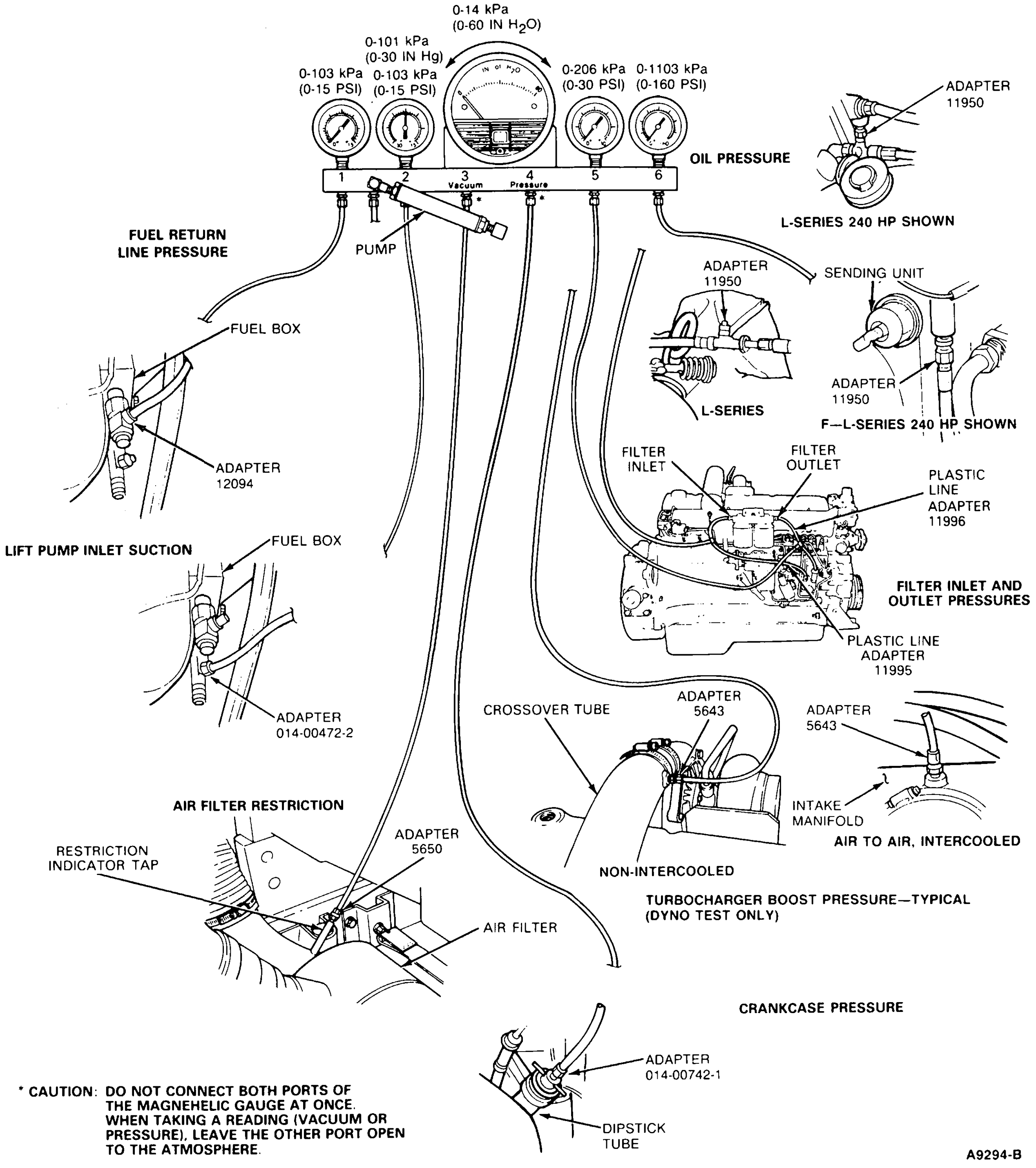
10. The injector nozzles must be removed from the engine for testing. This is a functional test of injector nozzle performance which checks opening pressure, spray pattern and leakage.

11. **Compression and Crankcase Pressure:** These tests examine the condition of internal components of the engine. Low compression indicates leakage past the piston rings or valves. Crankcase pressure measures the amount of blow-by past the rings. Excessive blow-by past the rings creates high pressure in the crankcase. The crankcase pressure test will also indicate a clogged crankcase ventilation system. Compression testing, crankcase pressure readings and rate of oil consumption should be used to evaluate engine mechanical condition.

12. **Turbocharger:** These tests and checks examine the condition of the turbocharger to determine if it is affecting engine performance. Problems which can be caused by a turbocharger include low power, excessive exhaust smoke, excessive engine oil consumption, noise and oil leaks. Most turbocharger checks are performed with the engine off. Boost pressure, although not included in the engine performance section, can be checked, but it requires a dynomometer since a full load condition must be simulated. Specifications for turbocharger boost are given in the Engine Performance Specifications section and an adapter is available with the pressure test kit for checking boost pressure.

To perform the Engine Performance Diagnosis procedure, it is necessary to connect the Rotunda Pressure Test Kit 014-00702 or equivalent (Figure 21). Use the explanations outlined under Pressure Testing With the Gauge Bar to help in attaching the gauges and interpreting the readings.

Engine Performance Diagnosis Procedure



* CAUTION: DO NOT CONNECT BOTH PORTS OF THE MAGNEHELIC GAUGE AT ONCE. WHEN TAKING A READING (VACUUM OR PRESSURE), LEAVE THE OTHER PORT OPEN TO THE ATMOSPHERE.

Figure 21 Pressure Test Kit Hookup

Engine Performance Diagnosis Procedure

Pressure Testing With the Gauge Bar

The gauge bar is used for several different pressure checks (Figure 21). Hookups are made using special adapters manufactured specifically for the 6.6L and 7.8L engines.

NOTE: Use of the gauge bar is not mandatory. Individual gauges can be used, as long as they are accurate and applicable to a particular check. Technicians who own their own set of gauges may find that buying the Adapter Kit 014-00733 will make it easier to hook their gauges into the 6.6L and 7.8L engines and systems.

Diagnostic tests that can be accomplished with the gauge bar along with hookup instructions are listed here:

Filter Inlet Pressure: Filter inlet pressure is measured by disconnecting the fuel line between the lift pump and the fuel filter inlet. In its place, a plastic line (11995) from the pressure test kit is installed. This line is equipped with a T-connection so that a pressure tap to the gauge bar can be made. Attach a line from the T-connection to the 0-1103 kPa (0-160 psi) gauge.

Filter Outlet Pressure: Filter outlet pressure is measured by disconnecting the fuel line between the fuel filter outlet and the inlet to the fuel injection pump. In its place, a plastic line (11996), from the pressure test kit is installed. This line is equipped with a T-connection so that a pressure tap to the gauge bar can be made. Attach a line from the T-connection to the 0-206 kPa (0-30 psi) gauge.

Connect both the Filter Inlet and Filter Outlet Pressure adapters at the same time to check the following:

- Filter Inlet Pressure
- Filter Outlet Pressure
- Pressure Drop Across the Fuel Filters
- Lift Pump Output Pressure
- Injection Pump Inlet Pressure (Fuel Galley Pressure)
- Air Leaks in the Fuel System (look for air bubbles in the plastic fuel lines)

Lift Pump Inlet Suction: To measuer lift pump inlet suction, the coupling for the fuel line going into the fuel box from the fuel tank must be disconnected. At this point an adapter is screwed into the fuel box coupling and the fuel line coupling is screwed into the adapter. The adapter is equipped with a pressure tap which must be connected to 1-30 in Hg/0-15 psi gauge.

Fuel Return Line Pressure: To measure fuel return line pressure, the coupling for the fuel line going out of the fuel box to the fuel tank must be disconnected. At this point and adapter (12094) is screwed into the fuel box. The adapter is equipped with a pressure tap which must be connected to the 0-1 bar (0-103 kPa or 0-15 psi) gauge.

Oil Pressure: Oil pressure is checked by tapping into a flexible line between the oil filter support and oil pressure sender switch. Use adapter 11950 to attach to either a coupling in the line or at the oil pressure sender switch at the dash panel.

Air Filter Restriction: Air filter restriction is checked at the same port where the restriction indicator is located. To check air filter restriction, remove the restriction indicator and install the adapter (5650) from the pressure test kit in its place. Connect the adapter to the vacuum side of the magnehelic gauge.

Engine Performance Diagnosis Procedure

Crankcase Pressure: Crankcase pressure is measured from the dipstick tube. To make this check, remove the dipstick and install the adapter (014-00472-1) from the pressure side of the magnehelic gauge.

CAUTION: Do not connect both parts of the magnehelic gauge at once. When taking a reading (vacuum/pressure) leave the other port open to the atmosphere.

Turbo Boost Pressure: Turbo boost pressure is measured from a tap on the crossover tube or inlet manifold. Remove the tap and install the adapter (5643) from the pressure test kit. Connect the adapter to the 0-206 kPa (0-30 psi) gauge.

NOTE: Turbo boost pressure is checked **only on a dynomometer** or where **full load conditions** can be simulated.

Air Leak Testing

The gauge bar is equipped with a pressure pump. This pump can be used to pressurize fuel lines to help locate air leaks. Once an air leak is verified by seeing air bubbles in the fuel going to the injection pump, the exact location can be determined using the pressure pump and the following procedure:

1. Plug the end of the fuel line.
2. Install the pump into the system in front of the suspected air leak.
3. Pressurize the system to a maximum of 104 kPa (15 psi) and maintain pressure.
4. Wipe the fuel lines and connections with a soap and water solution.
5. An air leak will show up as bubbles.
6. Tighten the connection or replace components as needed to eliminate the leak.

Checking Fuel Cetane

Checking fuel is very important in diagnosis. Contaminants in the fuel, like water and microbiological organisms, are easy to see when a fuel sample is placed in a clear container. Diesel fuel should be clear, with an amber tint (actual color may vary). Water or particulates floating in the fuel are indicators of contaminated fuel. Diesel fuel must have a cetane rating of at least 40. Cetane can be checked using Rotunda Cetane Tester 078-00121 or equivalent (Figure 22).

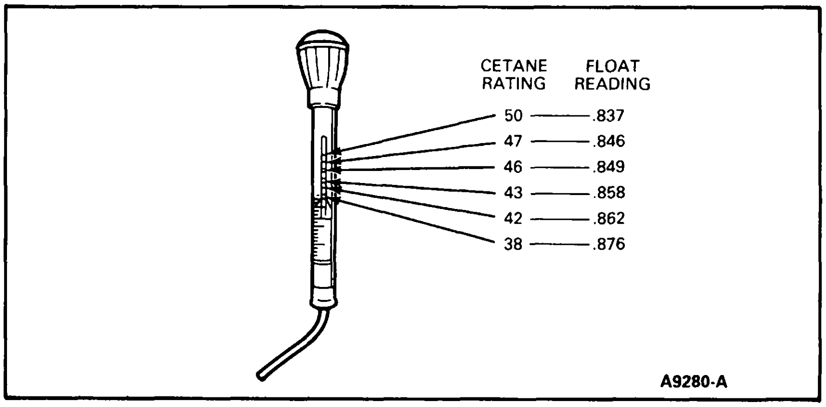


Figure 22 Centane Tester Float Readings, Rotunda 078-00121

Engine Performance Diagnosis

Pinpoint Test **EPC**

TEST STEP	RESULT ►	ACTION TO TAKE
EPC.1 CHECK FOR EXTERNAL LEAKAGE		
• With engine running, visually check for leakage of: 1. Fuel. 2. Engine oil. 3. Dirt past air cleaner. 4. Coolant. 5. Exhaust. 6. Boost air.	OK ►	GO to **EPC.2.**
	~~OK~~ ►	SERVICE or REPLACE faulty component(s). If performance problem still exists, GO to **EPC.2.**
EPC.2 CHECK EXHAUST SYSTEM		
• Visually check exhaust system for dents or kinks which could cause restriction.	OK ►	GO to **EPC.3.**
	~~OK~~ ►	SERVICE or REPLACE exhaust system components as required. REFER to Shop Manual Section 26-01. GO to **EPC.3.**
EPC.3 ACCELERATOR LINKAGE ADJUSTMENT		
• With engine off, check that control lever contacts injection pump stops. Control lever must contact low idle stop when accelerator pedal is released, and must contact high idle stop when accelerator is fully depressed.	OK ►	GO to **EPC.4.**
	~~OK~~ ►	ADJUST or SERVICE vehicle throttle linkage as necessary. REFER to Shop Manual Section 25-60. GO to **EPC.4.**
EPC.4 FUEL SYSTEM CONDITION		
• Inspect fuel supply and return lines and hoses for kinks, and all connections for tightness. **NOTE: If problem is "not starting", perform EPC.5A and EPC.5B.**	OK ►	GO to **EPC.5A.**
	~~OK~~ ►	SERVICE or REPLACE loose or damaged component(s). If performance problems still exist, GO to **EPC.5A.**

Engine Performance Diagnosis | Pinpoint Test | EPC

TEST STEP	RESULT ►	ACTION TO TAKE
EPC.5A CHECK FUEL FOR CONTAMINATION		
• Obtain a fuel sample and visually examine fuel in a clear container (including bottom of container), for particles, clouding, or liquid contamination, such as water.	OK ►	GO to **EPC.5B.**
	~~OK~~ ►	REPLACE engine and chassis fuel filters. CLEAN and/or SERVICE fuel system. REFER to Shop Manual Section 25-02. GO to **EPC.5B.**
EPC.5B CHECK FUEL FOR CETANE VALUE		
• Check cetane value of fuel sample taken in Test Step **EPC.5**, using Rotunda Cetane Tester 078-00121 or equivalent. • Cetane value should be minimum of 40.	More than 40 ►	GO to **EPC.6.**
	Less than 40 ►	GO to **EPC.7.** INFORM owner to change fuel source. **NOTE: Do not replace fuel injection pump because of low cetane problem.**
EPC.6 CHECK ENGINE IDLE SPEED		
• Check engine speed as outlined under Adjustments. • Bring engine up to normal operating temperature. • Idle speed is measured with manual transmission in NEUTRAL and automatic transmission in PARK. • Idle speed is shown on Vehicle Emission Control Information decal (VECI).	OK ►	GO to **EPC.7.**
	~~OK~~ ►	ADJUST idle speed as outlined in this Section. GO to **EPC.7.**

Engine Performance Diagnosis

Pinpoint Test

EPC

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.7 CHECK AIR INTAKE RESTRICTION		
● Remove air cleaner restriction indicator and install adapter 5650 and Rotunda Pressure Test Kit 014-00702 or equivalent. Refer to Figure 19. ● Run engine at 2600 rpm, no load. ● Record restriction reading. ● Restriction should not exceed 2.5 kPa (10 in of H_2O).	OK ▶	REMOVE adapter. INSTALL cap on air cleaner port. GO to **EPC.8A.**
	~~OK~~ ▶	REPLACE filter element and CHECK intake system for blockage. REPEAT **EPC.7.** If restriction indicator is not functioning correctly, REPLACE it.
EPC.8A FUEL FILTER OUTLET PRESSURE		
● Install adapter 11996 with Rotunda Pressure Test Kit 014-00702 or equivalent. Refer to Figure 19. ● Run engine at 2600 rpm with no load, transmission in PARK or NEUTRAL. ● Record pressure reading. ● Pressure should be 103-207 kPa (15-30 psi) at 2600 rpm.	OK ▶	GO to **EPC.8C.**
	Fuel pressure too low or fuel does not appear ▶	GO to **EPC.8B.**
	Fuel pressure too high ▶	GO to **EPC.8G.**
EPC.8B FUEL FILTER INLET PRESSURE		
● Install adapter 11995 with Rotunda Pressure Test Kit 014-00702 or equivalent. Refer to Figure 19. ● Run engine at 2600 rpm with no load, transmission in PARK or NEUTRAL. ● Record pressure reading. ● Pressure should be 103-193 kPa (15-28 psi) with a maximum allowable pressure drop across the filter of 48 kPa (7 psi).	OK ▶	GO to **EPC.8C.**
	Pressure drop is greater than 48 kPa (7 psi) ▶	REPLACE fuel filters. REPEAT **EPC.8B.**
	Pressure is below 103 kPa (15 psi) ▶	GO to **EPC.8C.**

Engine Performance Diagnosis

Pinpoint Test

EPC

TEST STEP	RESULT ►	ACTION TO TAKE
EPC.8C CHECK FUEL SYSTEM FOR AIR LEAKS		
• Run engine with adapters 11995 and 11996 installed, and observe clear plastic lines for air bubbles.	No bubbles present ►	GO to **EPC.8E.**
	Bubbles present ►	GO to **EPC.8D.**
EPC.8D CHECK CHASSIS FUEL LINES		
• Disconnect fuel supply line at engine and fuel tank. • Plug one end of line and connect pressure pump from Rotunda Pressure Test Kit 014-00702 or equivalent to other end of line. Refer to Figure 19.	Bubbles present ►	SERVICE or REPLACE any leaking connections or fittings. REFER to Shop Manual Section 25-50. REPEAT **EPC.8C.**
• Apply a maximum of 103 kPa (15 psi) to line, and hold pressure. • Apply a soap and water solution to all connections and fittings, and look for air bubbles.	No bubbles present ►	SERVICE ends of fuel supply lines. CHECK fuel tank pickup for leaks. SERVICE or REPLACE fuel tank pickup. REFER to Shop Manual Section 25-50. REPEAT **EPC.8C.**
EPC.8E CHECK LIFT PUMP		
• Connect adapter 12094 and Rotunda Pressure Test Kit 014-00702 or equivalent to fuel box. Refer to Figure 19. • Run engine at 2600 rpm with no load, transmission in PARK or NEUTRAL. • Record vacuum reading. • Vacuum must be a maximum of 34 kPa (10 in Hg).	OK ►	GO to **EPC.8F.**
	~~OK~~ ►	SERVICE or REPLACE restricted fuel supply line. REFER to Shop Manual Section 25-50. REPEAT **EPC.8E.**

Engine Performance Diagnosis

Pinpoint Test

EPC

TEST STEP	RESULT ►	ACTION TO TAKE
EPC.8F CHECK LIFT PUMP VOLUME		
- Disconnect lift pump outlet and connect a clean sample hose. - Disconnect fuel shutoff solenoid. - Place end of sample hose in clean, graduated container and crank engine for 30 seconds. - Volume should be a minimum of 0.47L (1 pint) in 30 seconds.	OK ► ~~OK~~ ►	GO to **EPC.8G.** REPLACE lift pump. REFER to Shop Manual Section 25-02. REPEAT **EPC.8F.**
EPC.8G CHECK FUEL RETURN PRESSURE		
- Disconnect fuel return line at fuel block. Install adapter 11950 and Rotunda Pressure Test Kit 014-00702 or equivalent. Refer to Figure 19. - Run engine at 2600 rpm with no load, transmission in PARK or NEUTRAL. - Record pressure reading. - Pressure should be a maximum of 41 kPa (6 psi) at 2600 rpm.	Fuel return pressure OK, EPC.8A OK ► Fuel return pressure OK, but fuel filter outlet pressure in EPC.8A high ► Fuel return pressure too high ►	GO to **EPC.9.** SERVICE or REPLACE injection pump overflow valve. REFER to Shop Manual Section 25-02. REPEAT **EPC.8A.** SERVICE or REPLACE fuel return line. REFER to Shop Manual Section 25-50. REPEAT **EPC.8G.**
EPC.9 CHECK STATIC TIMING		
- Check injection pump static timing as outlined in this Section.	OK ► ~~OK~~ ►	GO to **EPC.10.** ADJUST static timing as outlined.

Engine Performance Diagnosis

Pinpoint Test

EPC

TEST STEP	RESULT ►	ACTION TO TAKE
EPC.10 CHECK INJECTOR NOZZLES/LINES • Check injector nozzle lines for damage or restriction. • Remove injector nozzles. Refer to Shop Manual Section 25-02. • Test injector nozzles as outlined.	OK ►	GO to **EPC.11A.**
	~~OK~~ ►	REPLACE damaged lines. REFER to Shop Manual Section 25-02. CLEAN or REPLACE injector nozzles as outlined. REFER to Shop Manual Section 25-02 for Installation. If performance problem still exists, GO to **EPC.11A.**
EPC.11A CHECK COMPRESSION • Check engine compression as outlined.	OK ►	GO to **EPC.11B.**
	~~OK~~ ►	SERVICE engine as necessary. REFER to Shop Manual Section 22-11.
EPC.11B CHECK CRANKCASE PRESSURE • Remove engine oil dipstick and connect adapter 11949 and Rotunda Pressure Test Kit 014-00702 or equivalent. Refer to Figure 18. • Run engine at 2600 rpm with no load, transmission in PARK or NEUTRAL. • Record pressure reading. • Pressure should be a maximum of 0.7 kPa (3 in H_2O) at 2600 rpm.	OK ►	GO to **EPC.12A.**
	~~OK~~ ►	Problem is internal to engine. REFER to Shop Manual Section 22-11.

Engine Performance Diagnosis

Pinpoint Test

EPC

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.12A CHECK TURBINE/COMPRESSOR WHEELS		
• Visually check turbocharger turbine and compressor wheels for evidence of contact with turbocharger housing or foreign object damage (bent, broken, chipped or eroded blades).	OK ▶	GO to **EPC.12B.**
	~~OK~~ ▶	DETERMINE source of foreign object ingestion. SERVICE or REPLACE turbocharger and/or other components as necessary. REFER to Shop Manual Section 25-45.
EPC.12B OIL LEAKAGE-EXHAUST PIPE ELBOW/TURBINE HOUSING		
• Check for oil deposits at connection between exhaust pipe elbow and turbine outlet. **NOTE: Slight amount of oil seepage is normal after extended periods of idling.**	OK ▶	GO to **EPC.12C.**
	~~OK~~ ▶	REPLACE turbocharger. REFER to Shop Manual Section 25-45.
EPC.12C OIL LEAKAGE-EXHAUST MANIFOLD/TURBINE HOUSING		
• Check for oil deposits in exhaust manifold between engine exhaust ports and turbine inlet.	OK ▶	GO to **EPC.12D.**
	~~OK~~ ▶	Problem is internal to engine. REFER to Shop Manual Section 22-11.
EPC.12D OIL LEAKAGE-INTAKE MANIFOLD/COMPRESSOR HOUSING		
• Check for oil deposits in intake manifold and compressor housing. **NOTE: Slight amount of seepage is normal after extended periods of idling.**	OK ▶	GO to **EPC.12E.**
	~~OK~~ ▶	CHECK for intake restriction. GO to **EPC.7.** If intake restriction is OK, GO to **EPC.12G.**

Engine Performance Diagnosis

Pinpoint Test **EPC**

TEST STEP		RESULT ▶	ACTION TO TAKE
EPC.12E	OIL LEAKAGE-OIL SUPPLY/DRAIN PIPE FLANGES		
⊖ Check for oil leaks at oil supply and drain pipe flanges. ⊖ Check oil drain pipe for clogging.		OK ▶	GO to **EPC.12F.**
		~~OK~~ ▶	SERVICE or REPLACE oil drain pipe. TIGHTEN attaching bolts to specification. REPLACE gaskets as necessary. REFER to Shop Manual Section 25-45.
EPC.12F	CHECK FOR AIR LEAKS		
⊖ Visually check for air and exhaust leaks at following: 1. Exhaust manifold to engine.[a] 2. Exhaust manifold to turbine inlet.[a] [b] 3. Turbine housing to center housing.[a] [b] 4. Turbine outlet to exhaust pipe elbow.[a] 5. Compressor housing to center housing. 6. Compressor outlet to intake manifold.[b] [c] 7. Compressor inlet to air cleaner duct. 8. Air cleaner.		OK ▶	GO to **EPC.12G.**
		~~OK~~ ▶	SERVICE or REPLACE leaking component(s). REFER to Sections 22-11, 25-41 and/or 25-45.
EPC.12G	CHECK BEARING PLAY		
⊖ Check turbocharger axial and radial bearing play. Refer to Shop Manual Section 25-45.		OK ▶	REPLACE fuel injection pump. REFER to Shop Manual Section 25-02. ADJUST static timing as outlined.
		~~OK~~ ▶	REPLACE turbocharger. REFER to Shop Manual Section 25-45.

[a] Possible whistle or scream noise varying with engine speed.

[b] May show signs of carbon buildup.

[c] May cause low boost.

Injector Nozzle Testing

Where ideal conditions of good combustion, specified engine temperature control, and clean quality fuel prevail, nozzles require little attention. Nozzle trouble is usually indicated by one or more of the following symptoms:

- Exhaust smoke (black).
- Low power.
- Missing under load.
- Rough warm idle.
- Excessive fuel consumption.
- Engine will not rev up.
- Combustion knock.
- Overheating.

On Vehicle Testing

When faulty nozzle operation is suspected on an engine that is misfiring or puffing black smoke, a simple test can be made to determine the problem nozzle(s).

1. Run the engine at the rpm which makes the problem most pronounced.
2. Momentarily loosen the high-pressure fuel inlet line connection on one nozzle assembly. Listen to see if it has an effect on the engine and look to see if the smoke level changes. Then tighten the connection to specification.

   WARNING: BE EXTREMELY CAREFUL TO PREVENT BEING STRUCK BY DIESEL FUEL UNDER PRESSURE. DIESEL FUEL AT INJECTION PRESSURE CAN EASILY PIERCE THE SKIN, POSSIBLY CAUSING SEVERE INJURY FROM BLOOD POISONING. IF STRUCK BY PRESSURIZED DIESEL FUEL, SEEK MEDICAL HELP IMMEDIATELY.

3. Check each nozzle in the same manner.
4. If one nozzle is found where loosening makes no difference in performance or it causes the smoke level to change, that nozzle should be bench tested.

On Bench Testing

After removing the nozzle(s) from the engine, the injector nozzle pressure test should be performed. This test will provide valuable information regarding the condition of the nozzle(s). A clean workbench, clean washing fluid containers, clean tools and clean hands are essential to produce satisfactory results. Injector nozzles which are not functioning properly, have improper opening pressure, leak down, or spray patterns, should be replaced. Replacement injectors should be tested before assembly to engine.

Injector Nozzle Testing

Figure 23 shows the Rotunda Injector Nozzle Tester 014-00300, used for pressure testing the injector nozzles. Use the following procedure for testing the injector nozzles.

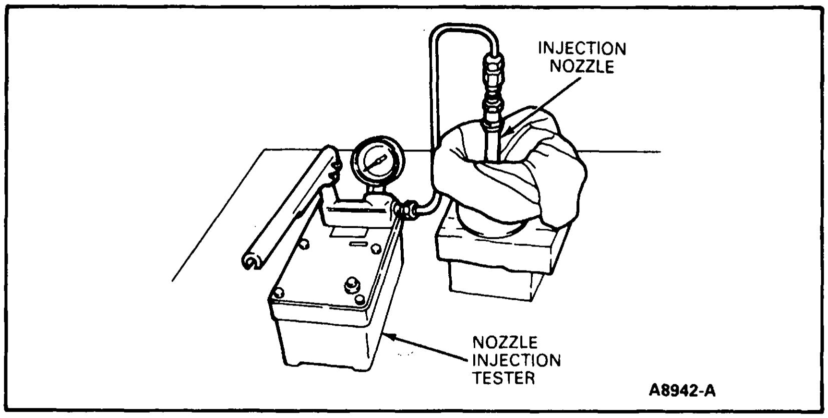


Figure 23 Injector Nozzle Tester

1. Prepare the stand for making tests. Place a container partly filled with rags beneath the outlet pipe to catch the spray. Fill the stand reservoir with clean calibration fluid. Open the tester valve slightly and operate the tester handle to expel the air from the tester and outlet pipe. Operate the tester until solid fuel (no air bubbles) flows from the end of the outlet pipe. Close the tester valve.

   NOTE: Test injector nozzles using SAE approved calibration oil 208629, SAE J967D, or ISO 4113 fluid, rather than diesel fuel.

2. Install the proper adapter for testing the 6.6L and 7.8L diesel injectors on the injector nozzle test stand.

3. Connect the nozzle to the test stand. Take care to avoid cross threading. Tighten connector nut securely with a wrench.

   WARNING: ALWAYS WEAR APPROVED SAFETY GLASSES WHEN OPERATING THE TESTER. VOLATILE LIQUIDS CAN BE EXTREMELY FLAMMABLE WHEN VAPORIZED. AVOID ANY CONDITIONS (SPARKS, OPEN FLAMES, LIT CIGARETTES, ETC.) WHICH MIGHT IGNITE THE FLUID USED DURING THE TEST PROCEDURE. ENSURE THAT THE INJECTOR IS MOUNTED ON THE TESTER SO THAT THE SPRAY IS DIRECTED AWAY FROM THE OPERATOR AND ANY OTHER PERSONS. THE ONLY LIQUID APPROVED FOR USE IN THIS TESTER IS SAE CALIBRATION NO. 208629 OR EQUIVALENT CALIBRATION FLUID (SAE J967D OR ISO 4113).

   WHEN A NOZZLE IS BEING TESTED OR IS IN OPERATION, KEEP HANDS AND OTHER PARTS OF THE BODY AWAY FROM THE SPRAYING NOZZLE. THE LIQUID SPRAY LEAVES THE NOZZLE TIP WITH SUFFICIENT FORCE TO PENETRATE THE SKIN AND CAUSE SERIOUS INJURY. THE NOZZLE TIP SHOULD BE ENCLOSED IN A TRANSPARENT RECEPTACLE IF AVAILABLE.

4. Bleed air from the nozzle. Open the tester valve and operate tester handle for eight to ten quick strokes to expel (bleed) air from the injector nozzle. Test fluid should spray from the spray holes in the nozzle tip. If the nozzle is blocked or the needle jammed, replace the injector. Replacement injectors should be tested before assembly to the engine.

Injector Nozzle Testing

NOTE: Conduct opening pressure, tip leakage and spray pattern tests separately. Do not attempt to evaluate more than one test step or result at a time.

5. **Check nozzle opening pressure** by pumping the injector nozzle tester and observing the pressure at which the needle valve lifts and fuel is ejected from the nozzle tip. Opening pressure must meet specifications or nozzle should be replaced.

6. **Check the nozzle for tip leakage.** Wipe the nozzle tip dry and operate the tester to maintain pressure at 2068 kPa (300 psi) below opening pressure of the nozzle. Hold the pressure for ten seconds. If droplets form on the tip of the injector and fall off, the nozzle should be replaced. Wetness on the tip of the injector is acceptable.

   NOTE: Do not wipe the tip with fingers, because it tends to draw a small amount of fluid out of the injector giving a false impression of a leak. Use a clean towel or blotting paper.

7. **Check the spray pattern of the nozzle** (Figure 24) by pumping the tester handle rapidly and observing the spray pattern coming from the orifices. Spray must come from each orifice and be similar in size and consistency. The spray should be well atomized and cone shaped as it comes from the injector nozzle. Injectors showing poor spray patterns should be replaced.

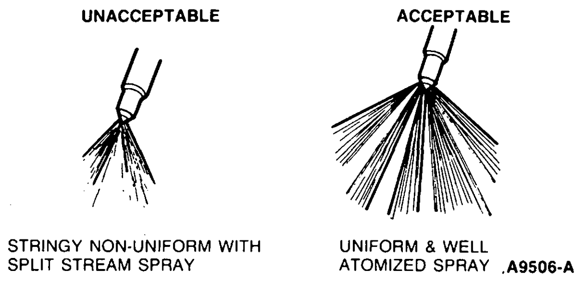

UNACCEPTABLE
ACCEPTABLE
STRINGY NON-UNIFORM WITH SPLIT STREAM SPRAY
UNIFORM & WELL ATOMIZED SPRAY
A9506-A

Figure 24 Spray Patterns

8. If the injector fails any of the tests, overhaul or replace the injector. Refer to Shop Manual Section 25-02.

Checking Compression

To check compression in the 6.6L and 7.8L engines use the following procedure:

1. Be sure battery performance meets specifications.
2. Clean the engine, especially the area around the injectors.
3. Warm up the engine by operating for a minimum of 30 minutes at 1200 rpm.
4. Stop the engine and remove the high-pressure fuel lines and fuel leak-off line from the engine. Cap all the openings in the fuel injection system and fuel injection pump.
5. Remove the injector nozzle and seat washer from each cylinder. Cap the injector nozzle and line to prevent the entry of dirt into the system. Place the injectors in a rack to prevent damage while they are removed from the engine and to keep them in order.

   CAUTION: If an injector is struck in the cylinder head and will not pull straight out, turn the injector in a clockwise direction to break it loose. If it is turned in a counterclockwise direction there is a chance that the nozzle and holder could unscrew from each other, allowing the internal components to fall out.

   NOTE: The lines should not be capped until residual fuel has been removed from them. Otherwise, when the engine is cranked during the compression test, the fuel remaining in the lines will blow the caps off. To remove the residual fuel, crank the engine after the fuel shutoff solenoid has been disconnected, then cap the lines.

6. Disconnect the electrical connector at the bottom of the fuel shutoff solenoid (Figure 25) and cover with tape. This must be done to shut off the flow of fuel to the engine during cranking.

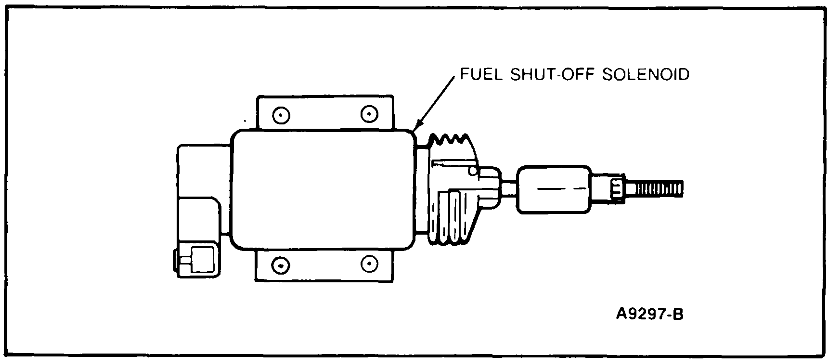


Figure 25 Fuel Shutoff Solenoid Terminals

7. Crank the engine to blow out any loose carbon particles from the injector bores.
8. Install the engine compression tester adapter 12210 into the injector bore of cylinder No. 1, using a new set washer and the injector mounting studs and nuts.
9. Connect Compression Gauge 014-00701 or equivalent and hose to the adapter.

Checking Compression

10. Crank the engine (speed must be at least 200 rpm) and observe the gauge reading. Allow about 6-8 puffs per cylinder.

11. Repeat Steps 7 through 10 for each cylinder.

12. After completing the compression check, install the injector nozzles using new seat washers. Connect the injector lines back on the engine and attach the connector at the bottom of the fuel shutoff solenoid.

Test Conclusions

1. Minimum compression must be at least 1896 kPa (275 psi). Also, compression readings from the lowest cylinder must be at least 75 percent of the highest.

2. If any of the readings do not meet the above specifications, this indicates that there is leakage at the cylinder head gasket, piston rings or valves.

NOTE: To determine if the rings or valves are at fault, squirt the equivalent of a tablespoon of heavy oil into the combustion chamber, then crank the engine to distribute the oil and repeat the compression test. The oil will temporarily seal leakage past the rings. During a compression test, if the pressure fails to climb steadily and remains the same during the first two succeeding strokes, or fails to climb during the entire test, suspect a sticking valve.

3. A low, even compression in two adjacent cylinders may indicate a cylinder head gasket leak. Check this before blaming the rings or valves.

OTHER PUBLICATIONS

THAT WILL ASSIST YOU IN CORRECTING DRIVEABILITY COMPLAINTS

1986
CAR & TRUCK ENGINE/EMISSION FACTS BOOK SUMMA
Ford
385-246
1987 CAR VACUUM & WIRING DIAGRAMS
1987 T-BIRD/ COUGAR
Electrical & Vacuum Trouble-Shooting Manual

ORDERING INFORMATION
A special order form is included in the back of this manual for your convenience if you desire to order.

ENGINE EMISSIONS FACTS BOOK

- The manual contains complete specifications for each calibration number.
- Published at the conclusion of the model year.

ELECTRICAL & VACUUM TROUBLESHOOTING MANUAL (EVTM)

- Available for all passenger car and light truck vehicles, this publication provides schematics of all electrical and vacuum circuits. Wiring diagrams show how the circuit is powered. Troubleshooting hints are provided to point the technician in a general direction but are not step by step procedures.
- Available in the first quarter of the model year. (One manual for each passenger car and light truck family.)

WIRING & VACUUM DIAGRAMS

- This publication contains wiring diagrams for all Ford and Lincoln/Mercury passenger car and light truck vehicles. A Power Distribution system illustrates the power distribution throughout each vehicle. In addition, all individual electrical circuits are shown for each vehicle line.
- Available in the first quarter of the model year.

Service Specifications Manuals

(CAR AND TRUCK)

- These manuals contain all specifications including maintenance and lubrication contained in the Shop Manuals in a handy pocket size for easy reference.
- Available in the first quarter of the model year.

SECTION 24

Diesel Diagnostics—6.9L Engine

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Preliminary Checkout

This Section covers adjustments, diagnostics, and test procedures for the 6.9L diesel engine Fast Start Glow Plug System and Fuel Injection System.

Checkout

- Visually inspect the engine compartment to ensure all wiring harnesses and fuel lines are properly routed, free of kinks and not contacting chassis or engine components and securely connected.
- Examine all wiring harnesses and connectors for insulation damage, burned, overheated, loose or broken conditions.
- Be certain the batteries are fully charged.
- All accessories should be OFF during testing and diagnosis.

Test Equipment

The following test equipment (Figs. 1 through 5) is required for adjusting idle speed and timing.

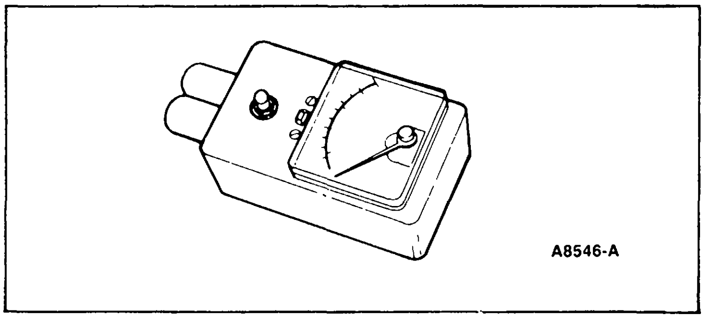


Figure 1 Rotunda 099-00001 Photoelectric Tachometer (For Engine RPM Checking Only)

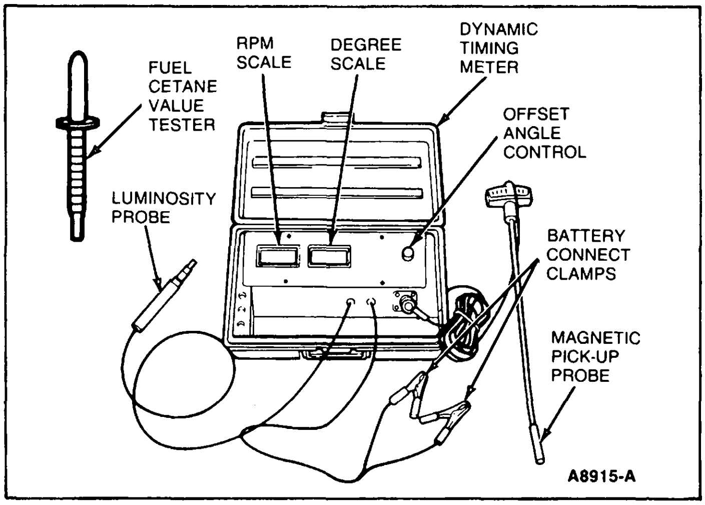


Figure 2 Rotunda 078-00100 Dynamic Timing Meter

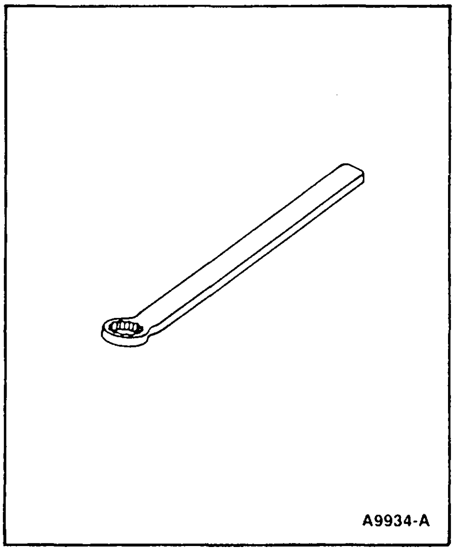


Figure 3 T86T-9000-C Injection Pump Mounting Wrench

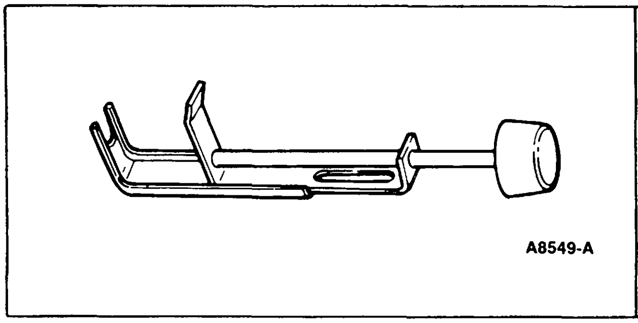


Figure 4 Rotunda 014-00302 Throttle Control Special Service Tool D83T-9000-E

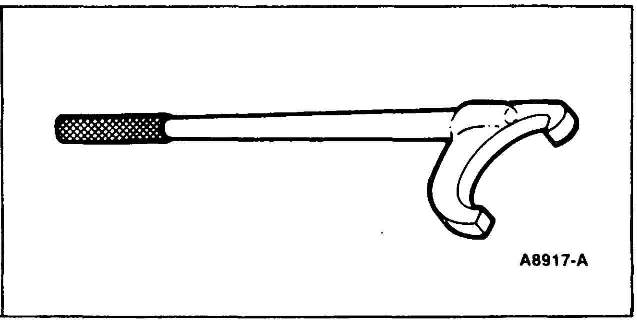


Figure 5 T83T-9000-C Injection Pump Rotating Tool

Test Equipment

The following test equipment (Figs. 6 and 7) is required for performing the Engine Performance Diagnostic Procedure.

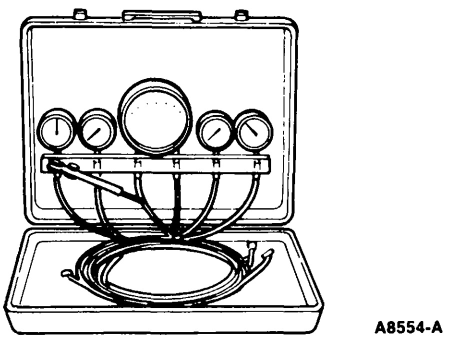


Figure 6 Rotunda 014-00702 Pressure Test Kit

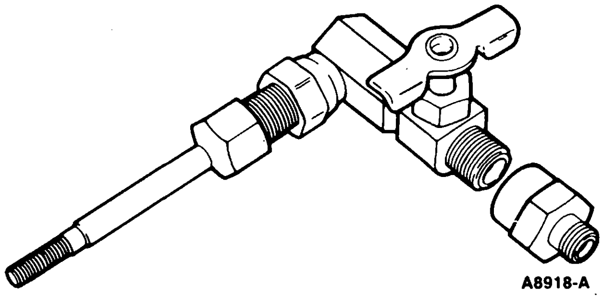


Figure 7 T83T-9000-A Fuel Transfer Pump Pressure Adapter

Test Equipment

The following test equipment (Figs. 8 and 9) is required for performing the WAIT TO START Lamp Diagnostic Procedure and the Fast Start Glow Plug System Diagnostic Procedure.

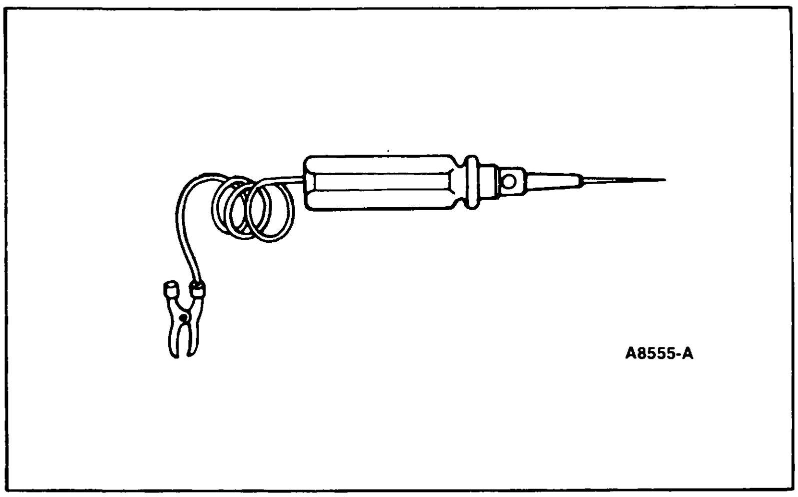


Figure 8 12-Volt Test Lamp

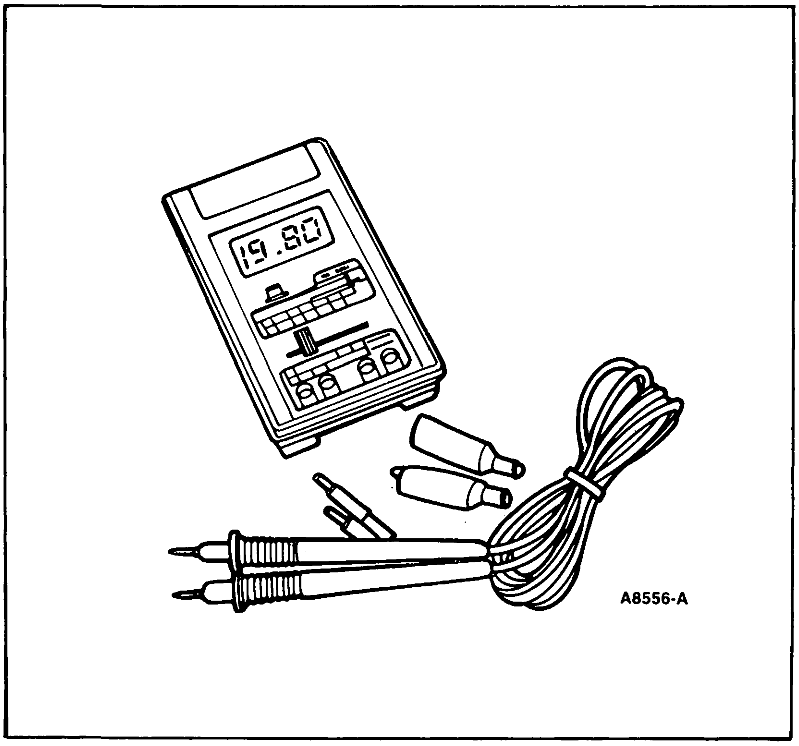


Figure 9 Rotunda 007-00001 Digital Multimeter

Test Equipment

The following test equipment (Figs. 10 and 11) is required for Injection Nozzle testing and cleaning.

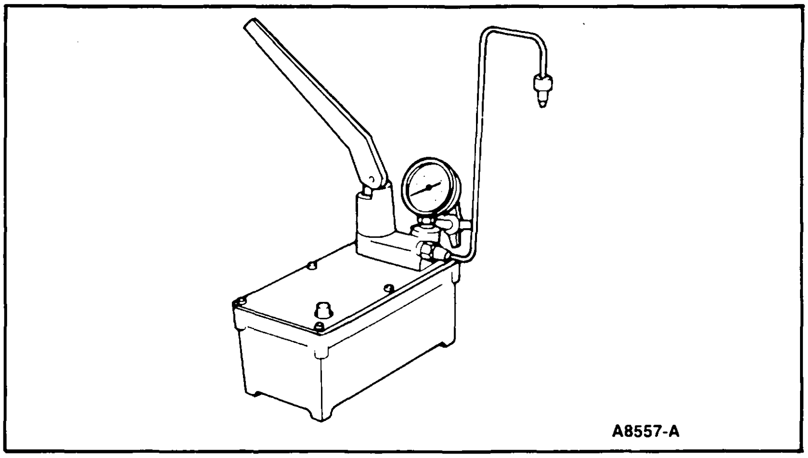


Figure 10 Rotunda 014-00300 Injector Nozzle Tester Special Service Tool D83T-9000-F

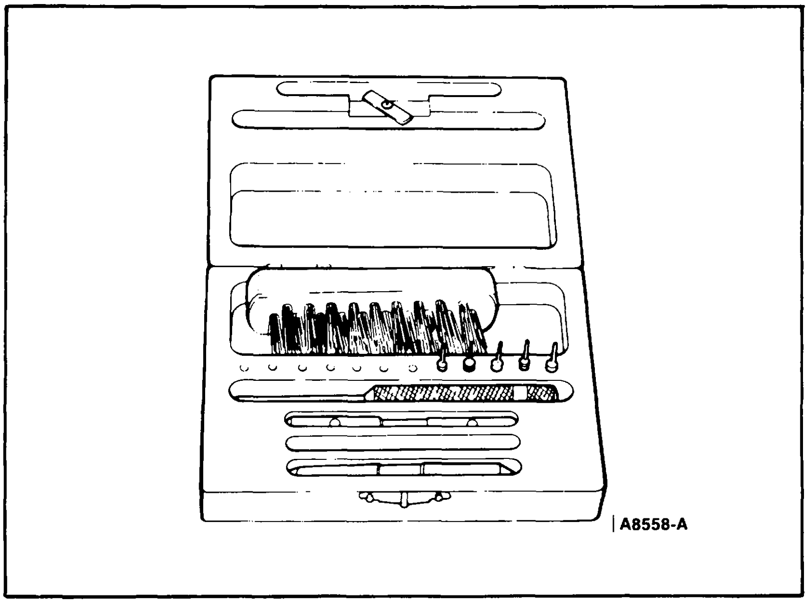


Figure 11 Rotunda 014-00301 Injector Nozzle Cleaning Kit Special Service Tool D83T-9000-G

Idle Speed Setting Procedures

Curb Idle Speed Adjustment

1. Place transmission in NEUTRAL or PARK.
2. Bring engine up to normal operating temperature.
3. Idle speed is measured with manual transmission in NEUTRAL and automatic transmission in DRIVE.
4. Ensure that curb idle adjusting screw is against the stop. If not, correct vehicle linkage.
5. Check curb idle speed, using Rotunda 099-00001 or equivalent. Curb idle speed is specified on the Vehicle Emissions Control Information (VECI) decal. Adjust to specification using idle speed adjusting screw (Fig. 12).
6. Place transmission in NEUTRAL or PARK. Rev engine momentarily. Place transmission in specified gear and check curb idle rpm. Adjust again if necessary.

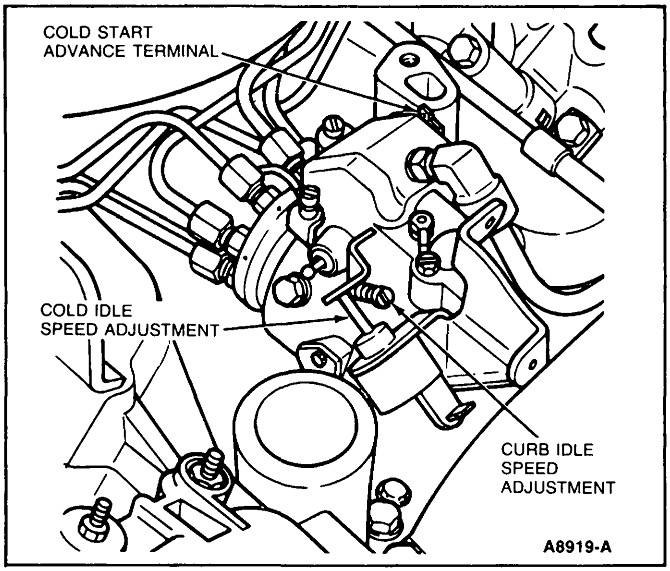

COLD START ADVANCE TERMINAL
COLD IDLE SPEED ADJUSTMENT
CURB IDLE SPEED ADJUSTMENT
A8919-A

Figure 12 Idle Speed Adjusting Screw

Fast Idle Adjustment

At Cold Idle Solenoid:

1. Place transmission in NEUTRAL or PARK.
2. Start engine, and bring up to normal operating temperature.
3. Disconnect fast idle solenoid from wiring harness.
4. Apply battery voltage to solenoid to activate it.
5. Rev engine momentarily to set solenoid to activate it.
6. Check fast idle speed setting. Fast idle rpm should be 875 + 25. Adjust to specification by turning solenoid plunger in or out (Fig. 12).
7. Rev engine momentarily and check fast idle rpm. Adjust as necessary.
8. Remove battery voltage from solenoid connector and connect to wiring harness.

Setting Injection Timing—Static Timing

1. Remove fast idle bracket and solenoid from injection pump.
2. Break torque (keeping nuts snug) on three nuts attaching injection pump to pump mounting adapter using Tool T86T-9000-C or equivalent (Fig. 3).
3. Install rotating Tool T83T-9000-C (Fig. 5), on front of pump and rotate injection pump to align timing mark on injection pump mounting flange with timing mark on pump mounting adapter, to within ± 0.030 inch.
4. Remove rotating tool and tighten nuts to specification. Visually check timing to verify that timing marks are aligned (Fig. 13).
5. Install fast idle bracket and solenoid and tighten bolts to specification.

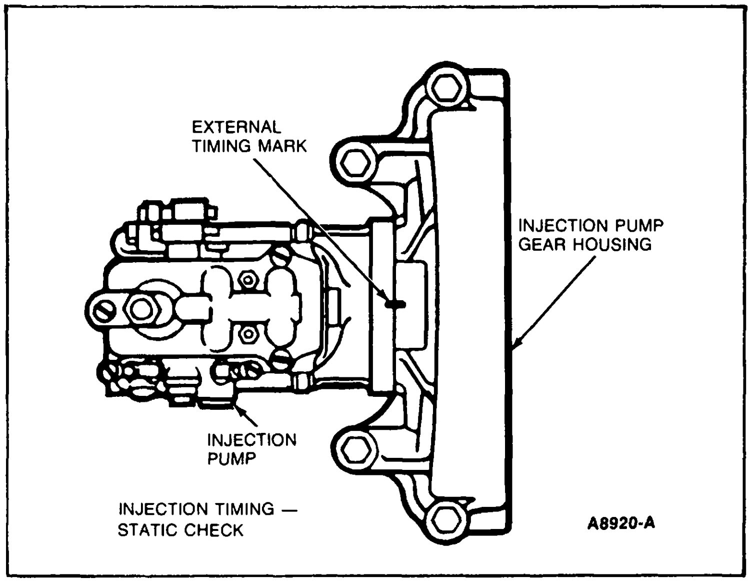


Figure 13 Injection Pump Timing Marks

Setting Injection Timing—Dynamic Timing

1. Bring engine up to normal operating temperature.

   NOTE: When checking or setting dynamic injection timing on the 6.9L engine it is mandatory that the engine be stabilized at normal operating temperature (192°F-212°F). This temperature is needed to ensure proper fuel ignition in the precombustion chambers. If the engine temperature is below 192°F, fuel ignition is delayed and the dynamic timing meter (Rotunda 078-00200) will record an incorrect dynamic injection timing value. Specified timing is shown in Fig. 18.

2. Obtain a fuel sample and check cetane value using tester Rotunda 078-00121 supplied with Rotunda 078-00200 or equivalent.

   Fuel quality or cetane value is determined by measuring the specific gravity of the fuel, with the fuel temperature within a range of 24°C-35°C (75°F-95°F). Poor fuel quality can affect diesel engine performance.

   Check the fuel cetane value as follows:

   a. Fill the glass hydrometer container with fuel until the hydrometer floats.

   b. Gently spin the unit to break the surface tension. Read the number at the lowest point of the fuel level in the hydrometer (Fig. 14). Record number and refer to cetane value conversion chart (Fig. 15).

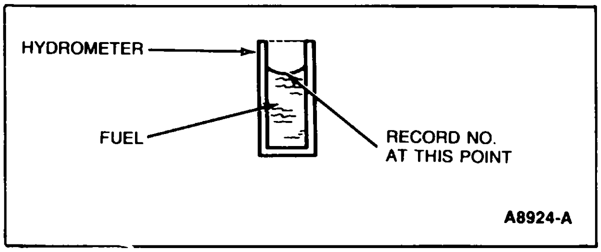


Figure 14 Reading Hydrometer

Hydrometer Reading	Cetane Value
.837	50
.846	47
.849	46
.858	43
.862	42
.876	38

Figure 15 Cetane Value Conversion Chart CA8925-A

3. Stop engine and install Dynamic Timing Meter, Rotunda 078-00100 or equivalent, by placing magnetic pickup in timing pointer probe hole (Fig. 16). Insert pickup until it almost touches vibration damper.

   NOTE: To prevent incorrect readings, ensure that vibration damper is clean and free of foreign debris and rust scale. If required, sand the area to remove rust and apply a light coat of paint to the area.

4. Disconnect No. 1 glow plug wire and remove glow plug using Tool D83T-6002-A, or equivalent. Install luminosity probe and tighten to 16 N•m (12 lb-ft). Install photocell over probe (Fig. 17).

Setting Injection Timing—Dynamic Timing

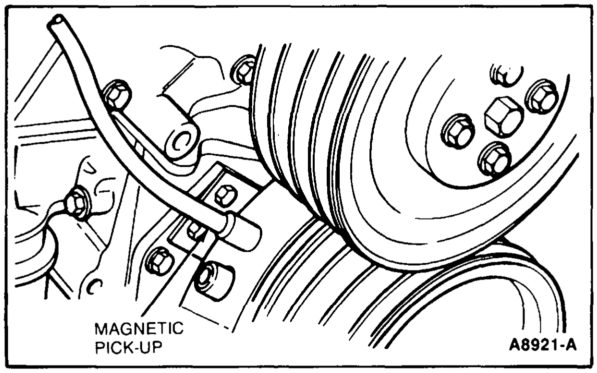


Figure 16 Magnetic Pickup—Dynamic Timing

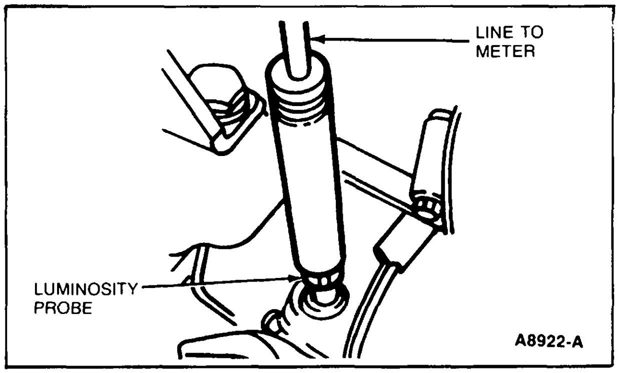


Figure 17 Luminosity Probe—Dynamic Timing

5. Connect dynamic timing meter to battery and dial in 20 degrees offset on meter. Disconnect cold start advance solenoid connector from solenoid terminal (Fig. 12).

   NOTE: Ensure that all wire leads are located away from the front accessory drive belts.

6. With transmission in NEUTRAL and rear wheels raised off the ground, start engine. Using Rotunda 014-00302, set engine speed to 1400 RPM with no accessory load. Observe injection timing on dynamic timing meter.

7. Apply battery voltage to cold start advance solenoid terminal to activate it.

   NOTE: Activating cold start advance solenoid can result in engine speed increase. Adjust throttle control to attain 1400 rpm, if required.

8. Check timing at 1400 rpm. The timing should be advanced at least 2.5 degrees before the timing obtained from Step 9 of the Dynamic Timing Procedure. If the advance is less than 2.5 degrees, replace fuel injection pump top cover assembly.

9. If dynamic timing is not within ± 2° of specification, adjustment of pump timing is necessary.

10. Turn engine off. Note timing mark alignment. Remove fast idle bracket and solenoid from injection pump. Break torque (keeping nuts snug) on nuts attaching injection pump to pump mounting adapter with Tool T86T-9000-C or equivalent.

11. Install rotating tool, T83T-9000-C or equivalent, on front of pump. Rotate clockwise (when viewed from front of engine) to retard, and counterclockwise to advance timing, by lightly tapping tool with a rubber mallet. Two degrees of dynamic timing is approximately 0.75mm (.030 inch) of timing mark movement.

12. Remove rotating tool and tighten nuts to specification. Start engine and recheck timing to verify timing. Repeat Steps 10, 11 and 12 as necessary, to set timing to ± 1° of specification.

13. Turn engine off. Remove dynamic timing components. Lightly coat glow plug threads with anti-seize compound, install glow plug and tighten to specification. Connect glow plug wire. Install fast idle bracket and solenoid and tighten bolts to specification.

System Description and Diagnosis

Fuel Cetane Value	Calibration	
	4-68J ROO	4-68X ROO
38-42	3.5 degrees ATDC	4.5 degrees ATDC
43-46	2.5 degrees ATDC	3.5 degrees ATDC
47 or greater	1.5 degrees ATDC	2.5 degrees ATDC

*Installation or resetting tolerance for dynamic timing is ± 1 degree. Service limit is ± 2 degrees.

Figure 18 Dynamic Timing Specifications

CA8923-B

This portion of this Section contains a brief description of the 6.9L diesel engine "WAIT TO START" Lamp System, Solid State Glow Plug System and Fuel Injection System. It also contains detailed diagnostic procedures for these systems.

The diagnostic procedures are broken into two parts. The first part is Symptom Analysis. This section should be consulted first, as it will direct you to perform a specific service or it will direct you to a specific diagnostic procedure.

The second part contains the "WAIT TO START" Lamp, Solid State Glow Plug System and Engine Performance diagnostic procedures. At the begining of each of these procedures, there is an explanation of how to use that procedure. Read this explanation before performing the tests.

"WAIT TO START" Lamp

The "WAIT TO START" lamp comes on when the ignition switch is turned to the Run position, and the engine is below normal operating temperature. It will remain lit for 4 to 10 seconds, depending on engine temperature. If engine is at or above normal operating temperature the lamp will not turn on.

NOTE: If the ignition key is left in the On position for an extended period of time or the engine is not started within the 2 minute cycling time, the glow plug system must be reset by turning the ignition key to Off position.

Solid State Glow Plug System

The solid state glow plug system consists of the glow plug controller, the glow plug harness assembly and glow plugs (Fig. 19).

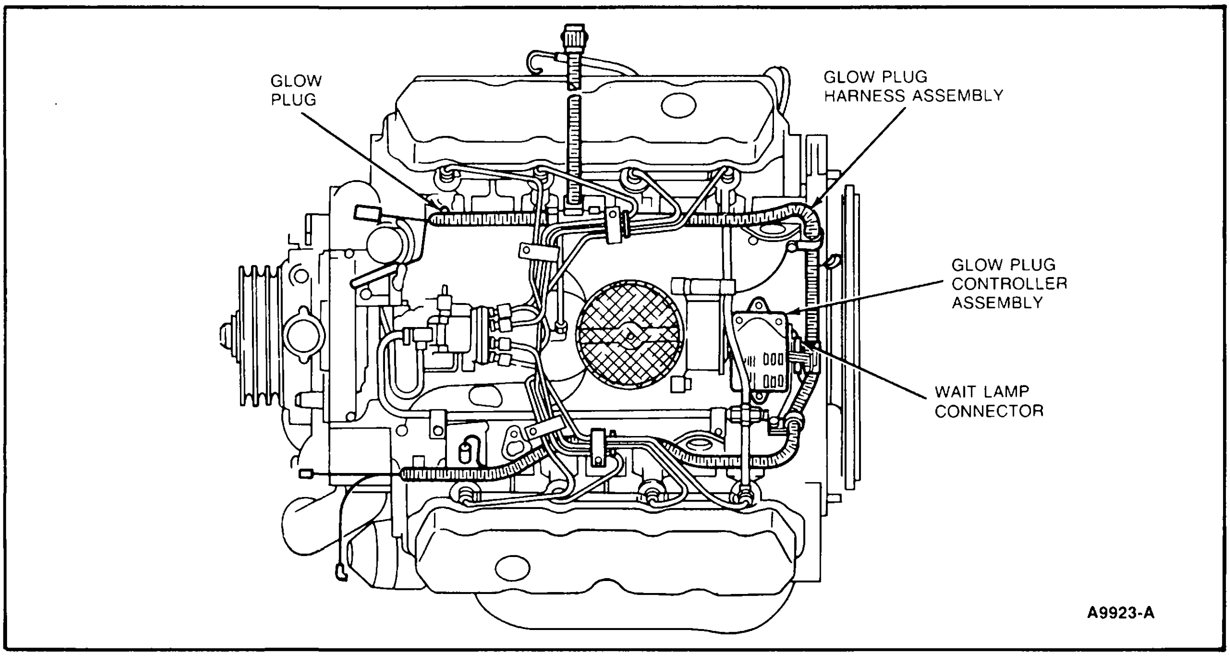


Figure 19 Solid State Glow Plug Control System

The system determines the glow plug temperature by electronically measuring the resistance of the glow plugs. It then maintains this temperature regardless of ambient temperatures.

The system is actuated when the ignition switch is turned to RUN. The "WAIT TO START" lamp lights until the glow plugs reach the proper temperature. The lamp goes out and the engine can be started.

The afterglow operation of the glow plugs continues after the "WAIT TO START" lamp turns off. The glow plugs cycle on and off for a period of time. This helps to reduce white smoke after engine start-up.

The glow plug system can be recycled by turning the ignition off and on. This immediately restarts the glow plug cycle. The engine can be started as soon as the "WAIT TO START" lamp goes off.

Solid State Glow Plug System

Glow Plug Controller

The power relay is mounted on top of the solid state controller circuit board. The complete assembly is mounted on the rear of the intake manifold (Fig. 20).

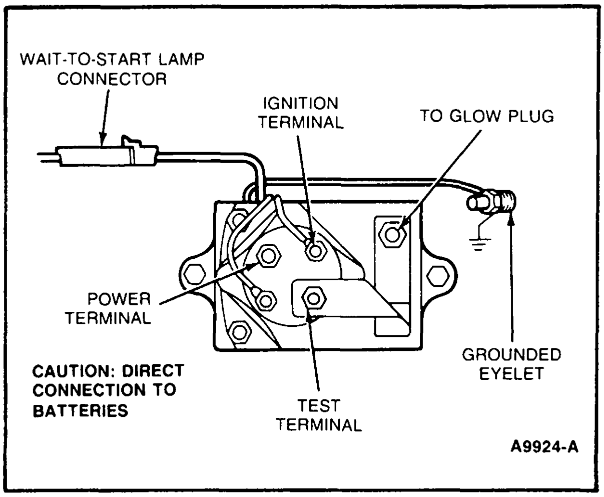


Figure 20 Solid State Glow Plug Controller

Glow Plugs

The system uses positive temperature coefficient (PTC) glow plugs. The resistance of the glow plugs changes as the temperature rises. The glow plugs use bullet-type terminals (Fig. 21).

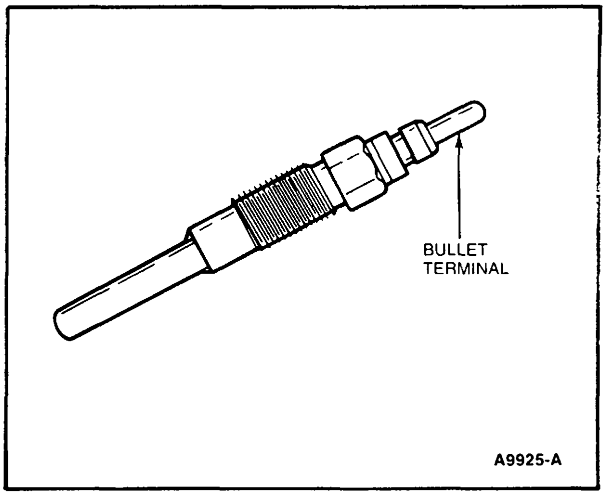


Figure 21 Glow Plugs

Solid State Glow Plug System

Wiring Schematic

Use the electrical schematic (Fig. 22) when diagnosing the glow plug system.

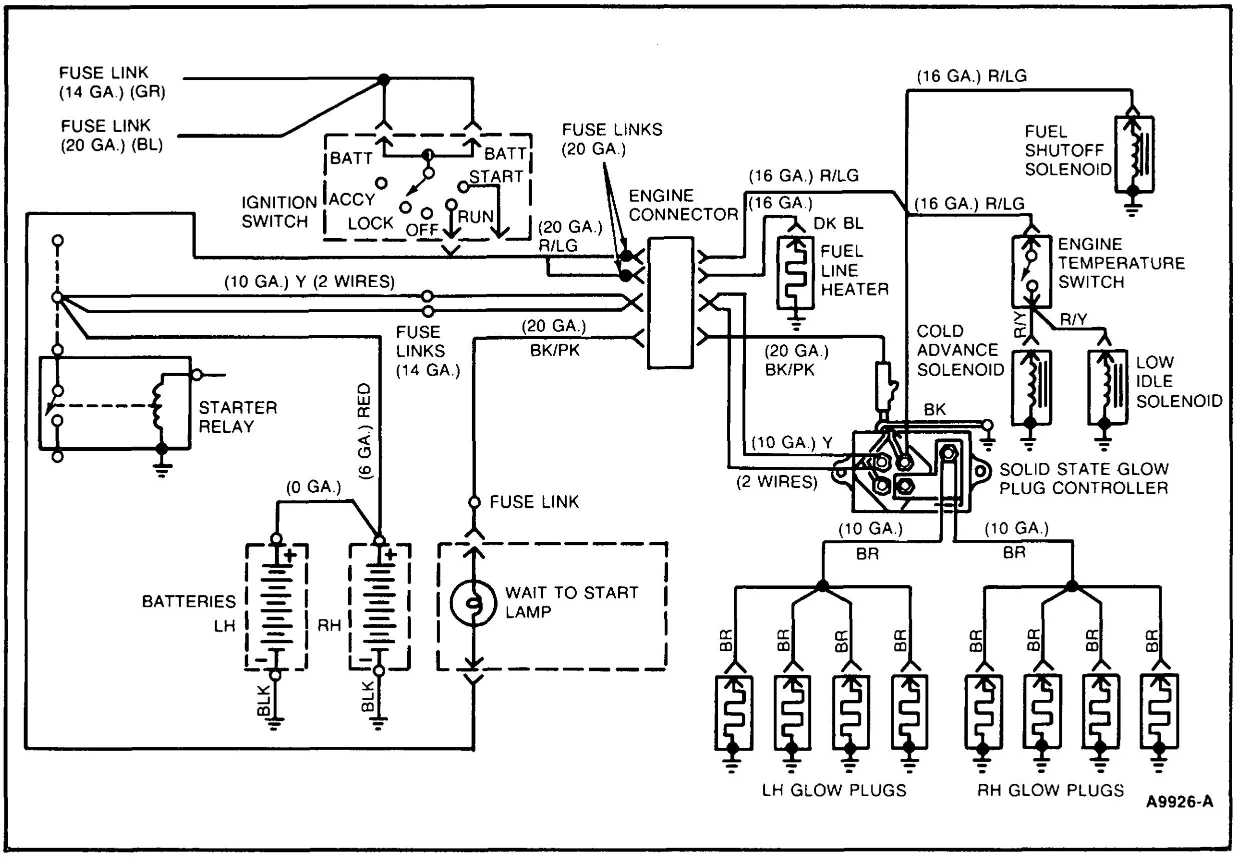


Figure 22 Wiring Schematic

Fuel System Description

Figure 23 shows a schematic of the fuel supply and return lines. The lift pump draws the fuel through the water/fuel separator from the supply tank. The fuel is then pumped through the fuel heater, and the fuel filter to the injection pump inlet. The injection pump then distributes the fuel to the injection nozzles.

Fuel is returned to the fuel tank by way of fuel return lines. A line runs off the fuel filter, then connects to the right bank of injection nozzles. This line connects at the rear left of the engine to the fuel return lines from the injection pump and left bank of injection nozzles. Fuel is then returned to the fuel supply tank.

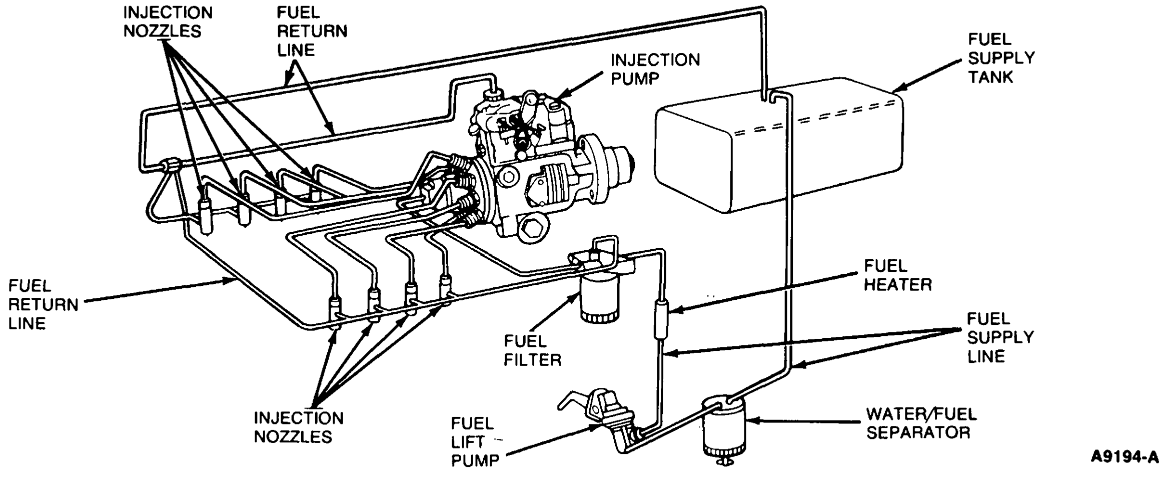


Figure 23 Fuel System Schematic

Symptom Analysis

The Symptom Analysis Diagnostic Procedures should be consulted first. These will direct you to a service to be performed or they will direct you to either the Fast Start Glow Plug System Diagnostic Procedure or the Engine Performance Diagnostic Procedure.

If the GLOW PLUG lamp is suspected of being faulty, go directly to the GLOW PLUG diagnostic procedure before performing the Glow Plug System Diagnostic Procedure.

If the problem is Loss of Power and/or Increased Fuel Consumption, go directly to the Engine Performance Diagnostic Procedure.

Evaluating "Normal" Diesel Engine Exhaust Smoke

The following is a description of what is "normal" and expected exhaust smoke for a vehicle with a diesel engine. Diesel exhaust smoke can be classified into two categories according to the color of the smoke.

The first category is blue-white smoke.

- Blue-white smoke may be observed at engine start-up whether the engine is up to operating temperatures or not. This start-up smoke will be observed at all ambient temperatures and should last no longer than a minute after the vehicle is driven.
- When ambient temperature is below 10°C (50°F), blue-white smoke can return after the engine warm-up due to extended idling. This is due to the combustion chambers cooling down during periods of extended idling time.

Heavy blue-white smoke will also occur when the engine is operated at wide-open throttle (accelerator pedal to the floor) with the transmission in Neutral or with a lightly loaded vehicle in any transmission gear setting. The smoke is a normal characteristic for a diesel engine with a light min.-max. governor spring in the fuel injection pump. This results in the following characteristics due to the engine operating above its rated speed (3300 rpm) in a no-load or lightly loaded condition:

- Heavy blue-white smoke.
- Fuel injection pump governor hunting resulting in high speed engine rpm surging.
- Engine sputtering or misfiring.

The conditions can be eliminated by not operating the engine above its maximum full load rated speed of 3300 rpm.

NOTE: Chassis fuel system air leaks may also cause continuous heavy blue-white smoke.

The second category of diesel exhaust smoke is black smoke. Black smoke occurs whenever the engine is working hard. The engine works hard when it is going up a steep grade, pulling a trailer, carrying a heavy load, or during acceleration. More black smoke will be observed when operating the vehicle at higher altitudes. If black smoke is observed while the engine is idling (at low altitude) or under normal driving conditions, the problem should be diagnosed as soon as possible.

Engine Cranks But Will Not Start (Cold)

TEST STEP	RESULT ▶	ACTION TO TAKE
A0 STARTING PROCEDURE		
NOTE: If the ignition key is left in the On position for an extended period of time or the engine is not started within the 2 minute cycling time, the glow plug system must be reset by turning the ignition key to Off position. • Check and follow correct starting procedure on vehicle visor.	OK ▶	RETURN vehicle to customer.
	~~OK~~ ▶	GO to **A1**.
A1 GLOW PLUG MODULE RELAY		
• Open hood. • Listen for glow plug module relay click when ignition switch is turned to ON position.	OK ▶	GO to **A2**.
	~~OK~~ ▶	GO to Glow Plug System Diagnostic Procedure.
A2 FUEL FLOW CHECK		
• Loosen one injection nozzle line nut (1/2 to one turn) while cranking engine.	Fuel discharges ▶	GO to Glow Plug System Diagnostic Procedure.
	Fuel does not discharge ▶	GO to **A3**.
A3 ENERGIZE TO RUN SOLENOID (ETR)		
• Check voltage at ETR solenoid (terminal located at front of injection pump) while cranking engine. Voltage must be at least 9 volts. • Check solenoid terminal for dirt/corrosion and loose/broken electrical connection.	OK ▶	GO to **A4**.
	~~OK~~ ▶	REFER to Shop Manual, Section 31-01. REPEAT Test Step **A3**.
A4 CHECK COLD IDLE SPEED/ADVANCE		
• Check voltage at cold advance solenoid (terminal located at left rear of injection pump) while cranking engine. Voltage must be at least 9 volts. • If no voltage is present, verify switching function of temperature sensing switch located behind thermostat housing.	OK ▶	GO to Engine Performance Diagnostic Procedure.
	~~OK~~ ▶	REFER to Shop Manual, Section 31-01. REPEAT Test Step **A4**.

Engine Cranks But Will Not Start (Normal Operating Temperature)

TEST STEP	RESULT ▶	ACTION TO TAKE
B0 STARTING PROCEDURE		
• Check and follow correct starting procedure on vehicle visor.	OK ▶	RETURN vehicle to customer.
	~~OK~~ ▶	GO to **B1**.
B1 FUEL FLOW CHECK		
• Loosen one injection nozzle line nut (1/2 to one turn) while cranking engine.	Fuel discharges ▶	GO to Engine Performance Diagnostic Procedure.
	Fuel does not discharge ▶	GO to **B2**.
B2 ENERGIZE-TO-RUN SOLENOID (ETR)		
• With ignition key in the ON position, check voltage at ETR solenoid (terminal at front of injection pump). Voltage must be at least 9 volts. • Check solenoid terminal for dirt/corrosion and loose/broken electrical connection.	OK ▶	GO to Engine Performance Diagnostic Procedure.
	~~OK~~ ▶	REFER to Shop Manual, Section 31-01. REPEAT Test Step **B2**.

Engine Quits, Stalls or Stumbles

TEST STEP	RESULT ▶	ACTION TO TAKE
C0 IDLE SPEED		
• Perform Test Step EPC.10 in the Engine Performance Diagnostic Procedure.	OK ▶	GO to C1.
	~~OK~~ ▶	ADJUST idle speed as described in this section, under Adjustments.
C1 ENERGIZE-TO-RUN SOLENOID (ETR)		
• Check ETR solenoid (terminal located at left front of injection pump) for dirt/corrosion and loose/broken electrical connection. While cranking, voltage must be at least 9 volts.	OK ▶	GO to C2 or C3 as required.
	~~OK~~ ▶	CLEAN, SERVICE or REPLACE terminal connection. REFER to Shop Manual, Section 31-01. REPEAT Test Step C1.
C2 COLD ADVANCE SYSTEM (COLD ENGINE)		
• Check voltage at cold advance solenoid (terminal located at left rear of injection pump) while cranking engine. Voltage must be at least 9 volts. • If no voltage is present, verify switching function of temperature sensing switch located behind thermostat housing.	OK ▶	GO to Engine Performance Diagnostic Procedure.
	~~OK~~ ▶	REFER to Shop Manual, Section 31-01. REPEAT Test Step C2.
C3 COLD ADVANCE SYSTEM (HOT ENGINE)		
• Check for voltage at cold advance solenoid (terminal located at left rear of injection pump) while cranking engine. No voltage should be present.	OK ▶	GO to Engine Performance Diagnostic Procedure.
	~~OK~~ ▶	REPLACE temperature sensing switch. REPEAT Test Step C3.

Engine Misses

TEST STEP	RESULT ▶	ACTION TO TAKE
D0 DETERMINE WHEN MISS OCCURS		
o Engine will miss when cold if one or more glow plugs are not heating.	Engine misses only when cold ▶	REFER to Glow Plug System Diagnostic Procedure.
	Engine misses at normal operating temperature ▶	GO to D1.
D1 ISOLATE MISS		
o Loosen each injection nozzle line nut (one at a time) while running engine. Refer to Injection Nozzle Testing in this section.	Miss not isolated to specific cylinder ▶	GO to Engine Performance Diagnostic Procedure.
	Miss isolated to specific cylinder(s) ▶	GO to D2.
D2 CHECK NOZZLE FUEL DELIVERY		
o Check injection nozzle fuel line(s) for kinks or restrictions as described in Shop Manual, Section 22-08.	Nozzle(s) and lines OK ▶	GO to D3.
o Perform injection nozzle test as described under Injection Nozzle Testing in this section.	Nozzle(s) and/or lines Not OK ▶	REPLACE defective line(s) as described in Shop Manual, Section 22-08. REPLACE nozzle(s) as described under Injection Nozzle Testing in this section.
D3 CYLINDER COMPRESSION CHECK		
o Perform cylinder compression test as described in Shop Manual, Section 22-08.	OK ▶	GO to Engine Performance Diagnostic Procedure.
	~~OK~~ ▶	GO to D4.
D4 CHECK CRANKCASE PRESSURE		
o Perform Engine Performance Diagnostic Procedure Test Step EPC.12.	OK ▶	SERVICE *or* REPLACE valve train as described in Shop Manual, Section 22-08.
	~~OK~~ ▶	OVERHAUL power cylinder as described in Shop Manual, Section 22-08.

Engine Knocks

TEST STEP	RESULT ▶	ACTION TO TAKE
E0 BELT DRIVEN ACCESSORIES		
• Check engine front drive components for proper operation.	OK ▶	GO to E1.
	~~OK~~ ▶	SERVICE or REPLACE as necessary. REFER to specific accessory Shop Manual Section.
E1 ENGINE COOLANT TEMPERATURE		
• Verify engine is not overheating.	OK ▶	GO to E2.
	~~OK~~ ▶	REFER to Shop Manual, Section 27-02.
E2 ISOLATE ENGINE KNOCK		
• Loosen each injection nozzle line nut (one at a time) while running engine. Refer to Injection Nozzle Testing.	Engine knock not isolated to specific cylinder ▶	GO to Engine Performance Diagnostic Procedure.
	Engine knock isolated to specific cylinder(s) ▶	GO to E3.
E3 CHECK NOZZLE FUEL DELIVERY		
• Check injection nozzle fuel line(s) for kinks or restrictions as described in Shop Manual Section 22-08. • Perform injection nozzle test as described under Injection Nozzle Testing.	Nozzle(s) and lines OK ▶	GO to Engine Performance Diagnostic Procedure.
	Nozzle(s) and/or lines not OK ▶	REPLACE defective line(s) as described in Shop Manual, Section 22-08. REPLACE nozzle(s) as described under Injection Nozzle Testing.

Low Oil Pressure With Proper Oil Level

TEST STEP	RESULT ▶	ACTION TO TAKE
F0 OIL PRESSURE TRANSDUCER • Verify accuracy of oil pressure transducer. Use Adapter 5633 with Pressure Test Kit 014-00702 or equivalent. Refer to Pressure Test Kit hookup illustration in this section.	OK ▶	GO to **F1**.
	~~OK~~ ▶	REPLACE transducer. REPEAT Test Step **F0**.
F1 CHANGE ENGINE OIL AND FILTER • Change engine oil and filter and run engine until normal operating temperature is reached. Check oil pressure reading.	OK ▶	RETURN vehicle to customer.
	~~OK~~ ▶	SERVICE or REPLACE lubrication system components as necessary. (REFER to Shop Manual, Section 22-08.)

Blue/White Smoke (Engine At Normal Operating Temperature)

TEST STEP	RESULT ▶	ACTION TO TAKE
G0 ENGINE TEMPERATURE		
NOTE: Refer to Symptom Analysis. • Verify that engine stabilizes in normal operating range.	OK ▶	GO to G2.
	~~OK~~ ▶	GO to G1.
G1 THERMOSTAT OPERATION		
• Remove thermostat. (Refer to Shop Manual, Section 22-08.)	OK ▶	REPLACE thermostat housing with integral air bleed check valve. REPEAT Test Step G0.
• Test thermostat for proper operation. (Refer to Shop Manual, Section 22-08.)	~~OK~~ ▶	REPLACE thermostat. (REFER to Shop Manual, Section 22-08). REPEAT Test Step G0.
G2 EXCESSIVE OIL LEVEL		
• Check engine oil level indicator for excessive oil fill.	OK ▶	GO to G3.
	~~OK~~ ▶	DRAIN excess oil from oil pan. If problem still exists, GO to G3.
G3 FUEL RETURN		
• Perform fuel return pressure test as described in Test Step EPC.5 of the Engine Performance Diagnostic Procedure.	OK ▶	PERFORM entire Engine Performance Diagnostic Procedure.
	~~OK~~ ▶	SERVICE or REPLACE fuel return line(s) as necessary. (Refer to Shop Manual, Section 24-50.) REPEAT test Step G3.

Excessive Black Smoke

TEST STEP	RESULT ▶	ACTION TO TAKE
H0 VERIFY SMOKE LEVEL		
NOTE: Refer to Symptom Analysis o Verify under what conditions black smoke occurs.	Light load and/or low altitude ▶	GO to **H1**. NOTE: For warranty claim approval, Engine Performance Chart must be filled out for the following steps: EPC.2; EPC.6; EPC.11; EPC.13.
	Under heavy load ▶	Normal when going up steep grades, pulling a trailer, maximum load, maximum acceleration or at high altitudes.
H1 EXHAUST SYSTEM CONDITION		
o Complete Test Step **EPC.2** of Engine Performance Diagnostic Procedure, and record problem description and results on Engine Performance Chart.	OK ▶	GO to **H2**.
	~~OK~~ ▶	SERVICE or REPLACE exhaust system as necessary. (REFER to Shop Manual, Section 26-01.) If problem still exists, GO to **H2**.
H2 CHECK AIR CLEANER RESTRICTION		
o Complete Test Step **EPC.6** of Engine Performance Diagnostic Procedure and record results on Engine Performance Chart.	OK ▶	GO to **H3**.
	~~OK~~ ▶	REPLACE air filter element and/or SERVICE system. REPEAT Test Step **H2**.

Excessive Black Smoke

TEST STEP	RESULT ▶	ACTION TO TAKE
H3 INJECTION PUMP TIMING		
• Complete Test Step EPC.10 of Engine Performance Diagnostic Procedure and record results on Engine Performance Chart.	OK ▶	GO to H4.
	~~OK~~ ▶	ADJUST timing. (REFER to Adjustments in this section.) If problem still exists, GO to H4.
H4 INJECTION NOZZLES		
• Complete Test Step EPC.11 of Engine Performance Diagnostic Procedure and record results on Engine Performance Chart.	OK ▶	REPLACE injection pump as described in Shop Manual, Section 22-08.
	~~OK~~ ▶	REPLACE damaged injection nozzle fuel inlet lines (REFER to Shop Manual, Section 22-08). REPLACE nozzles as described in this section, and Shop Manual, Section 22-08. If problem still exists, REPLACE injection pump as described in Shop Manual, Section 22-08.

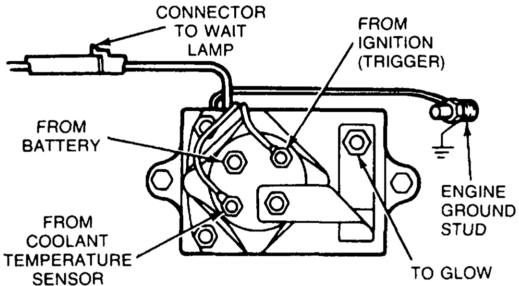
Solid State Glow Plug System Diagnostic Procedure

Perform the Glow Plug System Basic Diagnostic Test (hereafter referred to as Basic Test) first. If the vehicle passes the Basic Test without running any Pinpoint Tests, you will know the Glow Plug system is OK and the vehicle's problem exists somewhere else other than the Glow Plug System. However, if a step of the Basic Test fails, run only the Pinpoint Test specified by the failed step.

Refer to Figure 24 for test lamp connections and Glow Plug System wiring harness test points referred to in the Basic Test and the Pinpoint Tests. Perform only those services specified by the Pinpoint Tests.

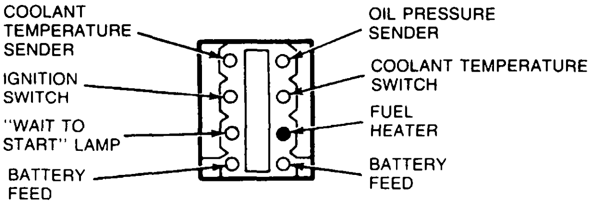
Operation of the Glow Plug System is completely automatic. If, after completing a specific Pinpoint Test it is determined that a component must be replaced, the glow plugs should be disconnected until system has been re-checked by repeating the Basic Test to make sure the Glow Plug System works properly.

A Fast Start Glow Plug System Troubleshooting Chart is available to the mechanic. It comes in pads of 100. The mechanic can take it right to the job with him and use it as a check list.



WIRE COLOR CODES

TERMINAL	COLOR
TRIGGER	DK. BLUE
GROUND	RED/WHITE
BATTERY	YELLOW
GLOW PLUGS	(LH) ORANGE/WHITE (RH) BROWN
WAIT LAMP	BLACK/PINK



Electrical Connector, Glow Plug Harness To Chassis Harness Chassis Side View

TERMINAL	WIRE COLOR CODES
IGNITION SWITCH	RED W/LIGHT GREEN STRIPE
"WAIT TO START" LAMP	BLACK W/PINK STRIPE
BATTERY FEED	YELLOW
BATTERY FEED	YELLOW
OIL PRESSURE SENDER	WHITE W/RED STRIPE
COOLANT TEMPERATURE SENDER	RED W/WHITE STRIPE
COOLANT TEMPERATURE SWITCH	RED W/BLACK STRIPE
IGNITION LEAD TO FUEL HEATER	DARK BLUE

A9882-A

Figure 24 Glow Plug System Diagnostic Test Points

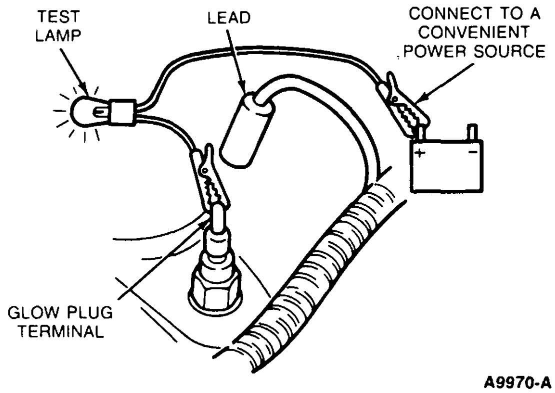
Glow Plug Pinpoint Testing

The following is a series of Pinpoint Tests that can be used to diagnose the glow plug system.

CAUTION: Never bypass the timed pulse function of the glow plug system. A constant 12V current to the glow plugs will cause them to overheat and fail within seconds, possibly resulting in severe engine damage.

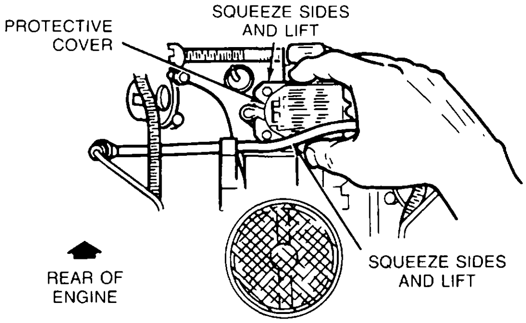
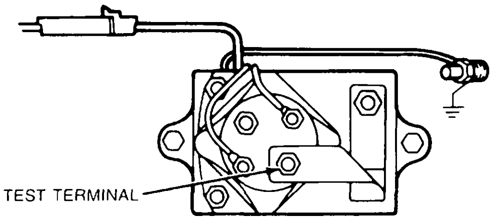
Glow Plug Testing

Pinpoint Test A

TEST STEP	RESULT ▶	ACTION TO TAKE
A1 CHECK GLOW PLUGS		
• Ignition switch OFF and leads removed from glow plugs. • Check continuity between glow plug terminal and a power source with glow plugs installed in engine.  TEST LAMP LEAD CONNECT TO A CONVENIENT POWER SOURCE GLOW PLUG TERMINAL A9970-A	OK ▶ ~~OK~~ ▶	GO to **A2**. REPLACE plug(s). GO to **A2**.

Glow Plug Testing

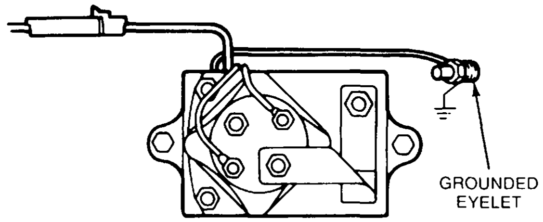
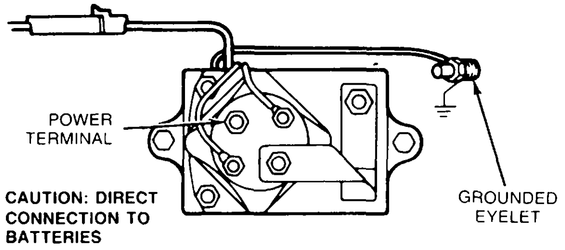
Pinpoint Test A

TEST STEP	RESULT ▶	ACTION TO TAKE
A2 CHECK HARNESS		
• Ignition switch OFF and leads removed from glow plugs. • Squeeze sides of protective cover and remove. • Check continuity between each glow plug lead and test terminal of control unit.	OK at all leads ▶	GO to **A3**.
	Not OK at any or all leads ▶	SERVICE or REPLACE harness. GO to **A3**.
 PROTECTIVE COVER SQUEEZE SIDES AND LIFT SQUEEZE SIDES AND LIFT REAR OF ENGINE A9971-A		
 A9972-A		

Glow Plug Testing

Pinpoint Test

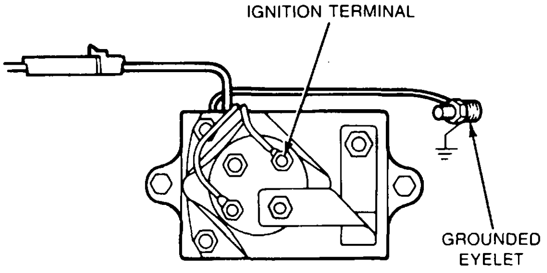
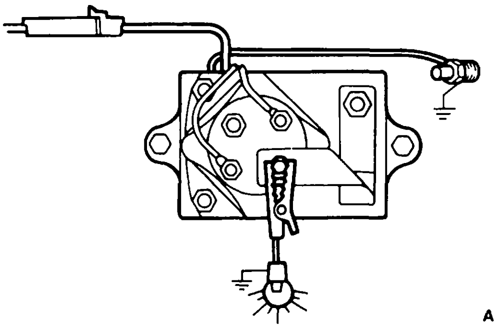
A

TEST STEP	RESULT ▶	ACTION TO TAKE
A3 CHECK CONTROL UNIT		
○ Ignition switch OFF. ○ Contact ohmmeter to ground wire terminal eyelet and to ground post on each battery.  A9973-A	Less than 1 ohm ▶	GO to A4.
	More than 1 ohm ▶	CLEAN or SERVICE ground connection. REPEAT check. GO to A4.
A4 CHECK SUPPLY VOLTAGE		
○ Ignition switch OFF. ○ Connect voltmeter to control unit power terminal and ground.  POWER TERMINAL CAUTION: DIRECT CONNECTION TO BATTERIES GROUNDED EYELET A9974-A	More than 10 volts ▶	GO to A5.
	Less than 10 volts ▶	SERVICE wiring or RECHARGE battery. GO to A5.

Glow Plug Testing

Pinpoint Test

A

	TEST STEP	RESULT	ACTION TO TAKE
A5	CHECK VOLTAGE FROM IGNITION SWITCH		
	• Check voltmeter to Ignition Terminal on control unit and ground.	More than 8 volts ▶	GO to **A6**.
	• Turn ignition switch ON and ALL accessories OFF.	Less than 8 volts ▶	CHECK fusible link, SERVICE wiring or RECHARGE battery. GO to **A6**.
	 A9975-A		
A6	FUNCTIONAL TEST		
	• With ignition switch OFF, connect 12 volt test light to test terminal on control unit.	Test light times within specifications ▶	System function is correct.
	• Position test light so it can be viewed from driver's position.	Test light times out of specifications ▶	DISCONNECT power at both batteries. REPLACE control unit. REPEAT test.
	• Turn ignition switch ON and monitor system operation.		
	• Compare test light times to Test Light Chart.		
	 A9976-A		

Glow Plug Testing

Pinpoint Test A

TEST STEP	RESULT ▶	ACTION TO TAKE

A6 FUNCTIONAL TEST (Cont'd)

TEST LIGHT CHART

NOTE: Total Test Light "ON" Time includes time from the begining of the initial "ON" cycle" to the end of the last "ON-OFF cycle" measured in seconds.

Control* Unit Temp. °F	"Wait-to-Start" Lamp "ON" Time (Sec.)	Test Light Total Time (Sec.)
-20°C	7-15	35-70
0°F	7-12	25-60
35°F	5-12	15-35
70°F	3-5	7-15
105°F	1-3	3-5
140°F	1 or Less	1-3

*Temperature of Control Unit, NOT ambient temperature

NOTE: The "Wait-to-Start" Lamp and/or Test Light may not illuminate if engine temperature is at or near normal operating temperature.

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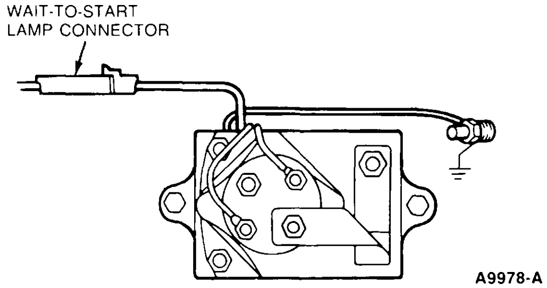
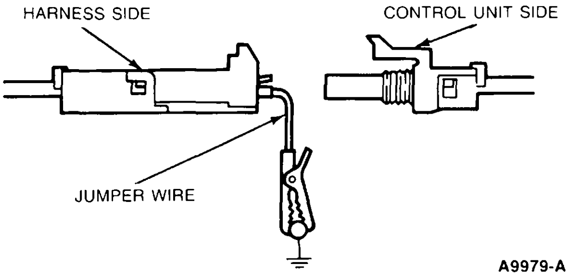
“Wait-To-Start” Lamp Testing

Pinpoint Test

B

TEST STEP	RESULT ▶	ACTION TO TAKE
B1 “WAIT-TO-START” LAMP STAYS ON		
• Disconnect the “wait-to-start” lamp connector at control unit. • Turn ignition switch ON. 	Lamp On ▶ Lamp Off ▶	SERVICE wiring to lamp. DISCONNECT power at both batteries. REPLACE control unit.
B2 “WAIT-TO-START” LAMP DOES NOT GO ON		
• Disconnect the “wait-to-start” lamp connector at control unit. • Connect jumper wire from Harness side to ground. • Turn ignition switch ON. 	Lamp On ▶ Lamp Off ▶	GO to Hard Starting Checks. REPLACE bulb or SERVICE wiring.

Glow Plug Failure Analysis

The following are examples of glow plug failure. Each example gives a different clue to glow plug failure analysis.

- There is no visible damage, but glow plug is electrically open (Fig. 25). This indicates an internal heating element failure.
- Glow plug tip that is missing can be caused by incorrect timing or poor fuel quality (Fig. 26).
- Multiple, distorted glow plugs are usually caused by electrical overheating (Fig. 27). A complete evaluation of the glow plug control system should be made.

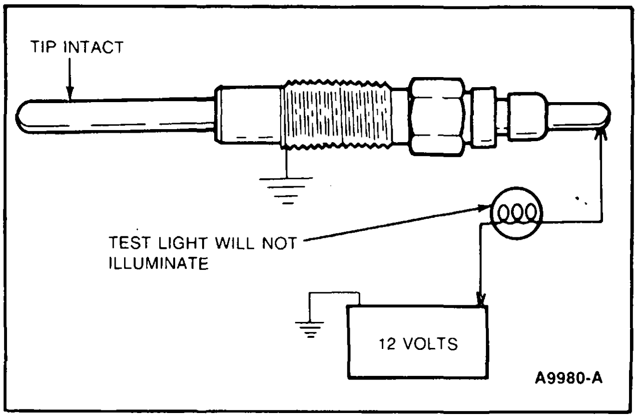


Figure 25 Electrically Open

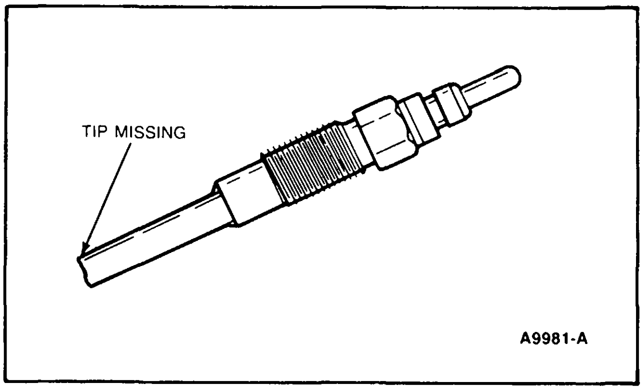


Figure 26 Missing Tips

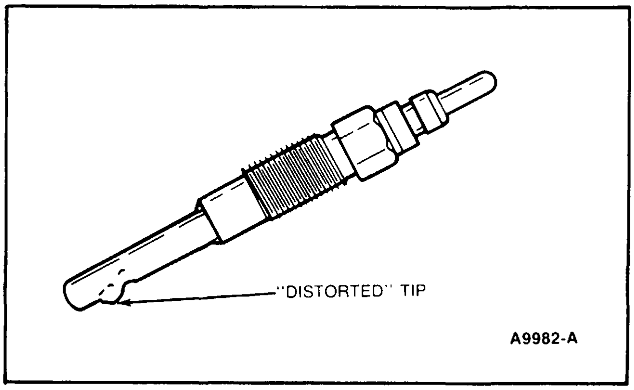


Figure 27 Distorted Tips

Engine Performance Diagnostic Procedure

The Engine Performance Diagnostic Procedure begins with those items which are the high frequency, easy-to-diagnose problems, and progresses to the low frequency, hard to diagnose problems. Use of this procedure will promote rapid as well as accurate diagnosis.

The Engine Performance Diagnostic Procedure follows, step by step, the Engine Performance Chart. Each test step is labeled to coincide with the Engine Performance Chart steps.

NOTE: Under no circumstances should the fuel injection pump be replaced until the Engine Performance Chart has been completely filled out. The only exceptions to this is in the case of Excessive Black Smoke (Symptom Analysis Diagnostic Procedure H) and external leaks. In these cases, only those steps specified need to filled out. Warranty claims for the fuel injection pump or injectors will not be accepted unless the Engine Performance Chart is filled out as specified and all tamperproof seals are intact.

NOTE: Repair each problem detected before going on to the next step. If the repair corrects the original complaint, it will not be necessary to proceed to the next test step. However, if the complaint is not corrected, continue with the test until the complaint is corrected.

The following explanations refer to the basic test steps of the Engine Performance Diagnostic Procedure and Chart. They give a brief description of the effect on performance these problems can create, giving you an understanding of the importance of each test step.

1. External Leakage: Fuel leakage can be a reason for diesel fuel smell or low economy. Oil leakage can be a reason for high oil consumption. An air intake system leak can shorten engine life, especially under dusty conditions. Coolant leakage can result in engine overheating.
2. Exhaust System Condition: Kinks or dents in the exhaust system can cause high exhaust back pressure. This can result in loss of power and high smoke levels.
3. Fuel Quality: Diesel engines need clean fuel, free of air, dirt and water. Any contamination may result in poor engine performance.
4. Fuel System Condition: Kinks in the fuel lines or hoses can block or restrict fuel flow and loose connections can leak air into the fuel. This can result in loss of power and high smoke levels.

   NOTE: The fuel supply system must deliver the proper quantity of fuel with no pressure loss or air leaks in chassis fuel system.
5. Fuel System Return Line Restriction: A restriction in the fuel return line will raise the pressure in the injection pump causing an adverse effect on injection pump timing, resulting in excessive smoke levels or loss of power.

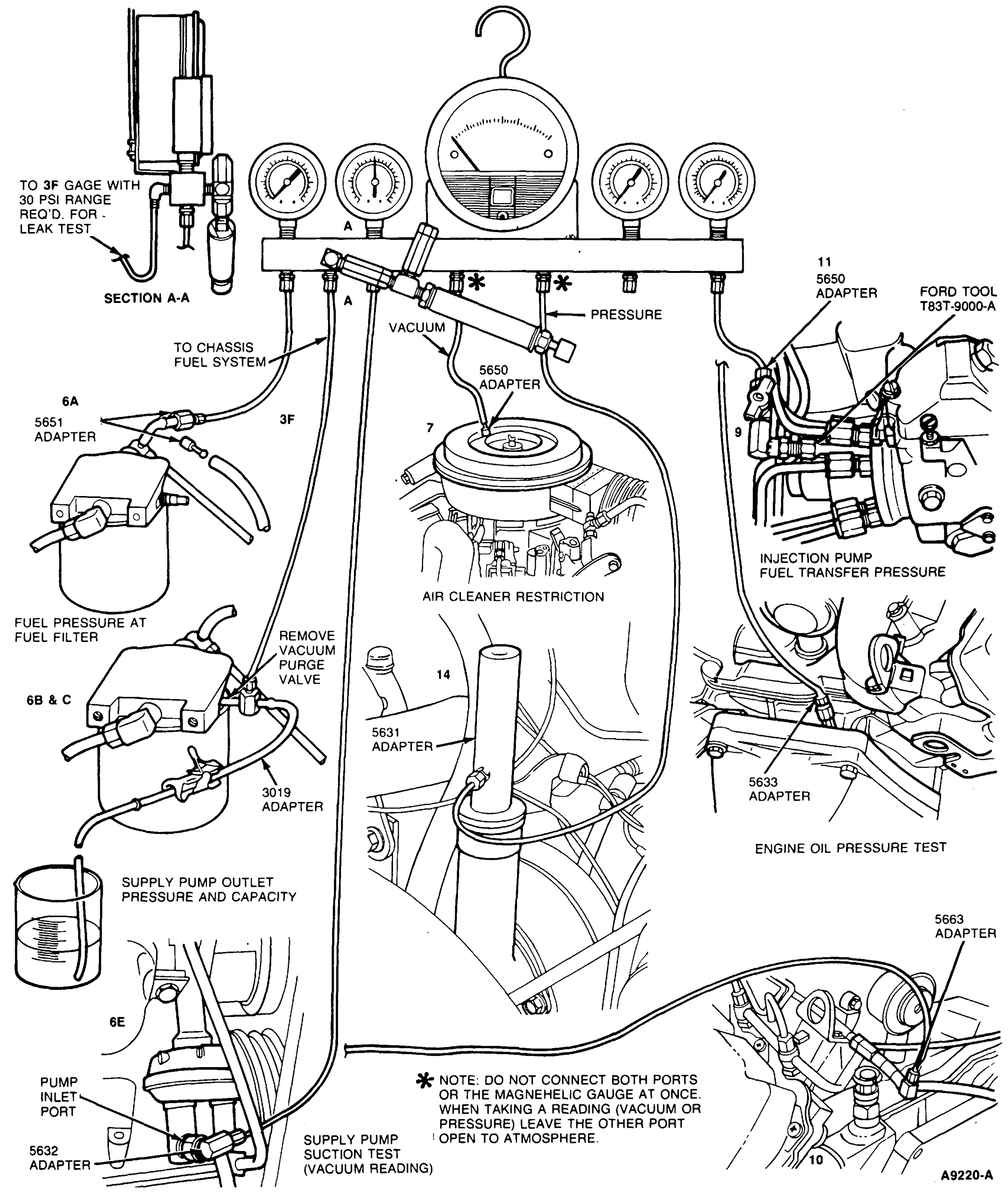
Engine Performance Diagnostic Procedure

6. Air Cleaner Restriction: A dirty air cleaner may result in low power, excessive smoke and poor fuel economy.
7. Transfer Pump Pressure: This is the pressure which is available to charge the injection plunger. Low pressure will result in low power, and excessive smoke levels.
8. Accelerator Linkage: If the accelerator linkage is improperly adjusted, the engine cannot reach full rated rpm and top speed and pulling power will be reduced, or curb idle speed will be excessive.
9. Engine Idle Speed: Low engine idle speed may cause stalling or rough running.
10. Injection Timing: Incorrect timing can be responsible for poor fuel economy, rough idling or hard starting and excessive smoke.
11. Injection Nozzle Test: The injection nozzles must be removed from the engine for this test. This is a functional test of injection nozzle performance. Incorrect nozzle performance will cause misses, poor fuel economy, loss of power and excessive smoke.
12. Crankcase Pressure: This test measures the amount of crankcase blow-by. More blow-by will create higher pressures. Crankcase pressure readings, plus rate of oil consumption, should be used to evaluate engine mechanical condition.

To perform the Engine Performance Diagnostic Procedure it will be necessary to connect the Pressure Test Kit, Rotunda 014-00702 or equivalent, to the various components as shown in Figure 28.

NOTE: If the problem is hard starting, follow the procedures for troubleshooting the glow plug system prior to troubleshooting the fuel system.

Engine Performance Diagnostic Procedure



* NOTE: DO NOT CONNECT BOTH PORTS OR THE MAGNEHELIC GAUGE AT ONCE. WHEN TAKING A READING (VACUUM OR PRESSURE) LEAVE THE OTHER PORT OPEN TO ATMOSPHERE.

Figure 28 Pressure Test Kit Hookup

Engine Performance

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.1 CHECK FOR EXTERNAL LEAKAGE		
○ With engine running, visually check for leakage of: 1. Fuel 2. Engine oil 3. Proper installation and dirt past air cleaner 4. Coolant	No leakage ▶	GO to **EPC.2**.
	Leakage detected ▶	SERVICE or REPLACE faulty component(s). If problem still exists, GO to **EPC.2**.
EPC.2 CHECK EXHAUST SYSTEM		
○ Visually check exhaust system for dents or kinks which could cause restriction.	OK ▶	GO to **EPC.3A**.
	~~OK~~ ▶	SERVICE or REPLACE exhaust system as required. (Refer to Shop Manual, Section 26-01) GO to **EPC.3A**.
EPC.3A CHECK FOR AIR IN FUEL		
○ Install a length of clear PVC hose in place of rubber hose between fuel filter outlet and injection nozzle return system. ○ Run engine for 2 minutes. Then, run engine at 3,000 rpm and check for bubbles in clear hose. **NOTE: Correct direction of fuel flow is from fuel filter towards fuel return system. Fuel flow in opposite direction is indication of restriction in fuel supply system.** **NOTE: On vehicles with dual fuel tanks, check with tank selector switch in each position for a minimum of two minutes.**	Fuel flow direction OK, bubbles less than 1.58mm (1/16 inch) diameter. ▶	GO to **EPC.3B**.
	Fuel flow direction OK, bubbles 1.58mm (1/16 inch) diameter or larger ▶	GO to Fuel System Air Leak Diagnosis in this Section. REPEAT Test Step **EPC.3A** when air leaks are eliminated.
	Fuel flow direction not OK ▶	GO to **EPC.5A**. REPEAT **EPC.3A**, when fuel flow direction is corrected.

Engine Performance

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.3B CHECK FUEL FOR CONTAMINATION		
• Obtain a fuel sample and visually examine fuel in a clear container (including bottom of container), for particles, clouding, or liquid contamination, such as water.	OK ▶	GO to **EPC.3C**.
	~~OK~~ ▶	REPLACE fuel filter. CLEAN and/or SERVICE fuel system as required. Refer to Shop Manual, Section 24-50. GO to **EPC.3C**.
EPC.3C CHECK FUEL FOR CETANE VALUE		
• Check cetane value of fuel sample taken in Test Step **EPC.3B** using cetane tester included with Dynamic Timing Meter, 078-00200 or equivalent. • Cetane value should be minimum of 40.	More than 40 ▶	GO to **EPC.4A**.
	Less than 40 ▶	Complete Tests EPC.4, 5, 6 and 8. INFORM owner* to change fuel source. GO to **EPC.4A**. *NOTE: Do not replace fuel injection pump because of low cetane problem.
EPC.4A FUEL FILTER OUTLET PRESSURE		
• Remove air bleed orifice hose from fuel filter fitting. • Install adapter 5651 with Pressure Test Kit 014-00702, or equivalent. (Refer to Pressure Test Kit Hook-Up Illustration.) • Run engine at 3,300 RPM, with no load. • Record pressure reading. On dual tank vehicles, check both tanks. • Pressure should be minimum of 1 psi at 3,300 RPM.	OK ▶	GO to **EPC.4C**.
	~~OK~~ ▶	GO to **EPC.4B**.

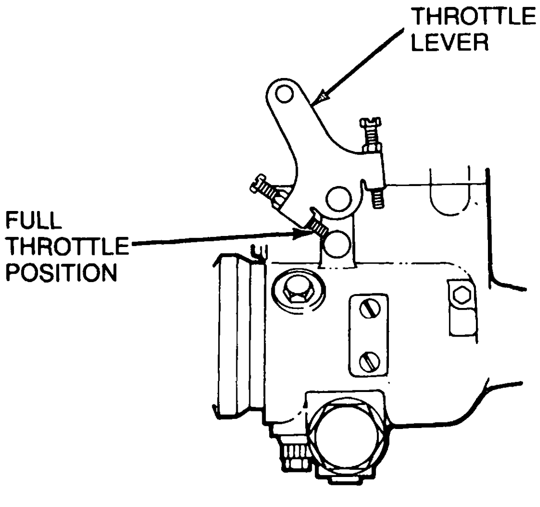
Engine Performance

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.4B FUEL SUPPLY PUMP OUTLET PRESSURE		
o Remove vacuum purge valve from fuel filter adapter. o Install adapter 3019 and Pressure Test Kit 014-00702, or equivalent. (Refer to Pressure Test Kit Hook-Up Illustration.) **NOTE: Make sure clamp is closed on sampling hose.** o Leave adapter from Test Step **EPC.4A** installed and cap end. o Run engine at idle, no load. o Record pressure reading. On dual tank vehicles, check both tanks. o Pressure should be minimum of 2 psi at idle.	OK ▶ ~~OK~~ ▶	REPLACE fuel filter and REPEAT Test Step **EPC.4A**. GO to **EPC.4C**.
EPC.4C FUEL PUMP CAPACITY		
o Position end of sample hose on adapter 3019 in a clear, one quart, graduated fuel container.	Pressure and volume OK ▶	GO to **EPC.5**.
o Follow procedures for Test Step **EPC.4B** and open clamp on sample hose, allowing fuel to flow into fuel container, for 30 seconds.	Pressure OK Volume Not OK ▶	GO to **EPC.4D**.
o Record volume. On dual tank vehicles, check both tanks.	Volume OK Pressure Not OK ▶	REPLACE fuel supply pump and REPEAT Test Step **EPC.4A**.
o Volume should be a minimum of one pint in 30 seconds at idle, no load.	Pressure and Volume Not OK ▶	GO to **EPC.4D**.

Engine Performance

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.4D CHECK RESTRICTION AT FUEL SUPPLY PUMP		
• Connect fuel return line removed in Test Step EPC.4A. • Install adapter 5632 and Pressure Test Kit to fuel supply pump inlet. • With rear wheels off the ground and transmission in NEUTRAL or PARK, run engine at 3,300 rpm. • Record vacuum reading. On dual tank vehicles, check both tanks. • Vacuum should be less than 6 inches Hg.	OK ▶	GO to EPC.4A.
	~~OK~~ ▶	SERVICE or REPLACE restricted chassis fuel line(s). Refer to Shop Manual, Section 24-50. REPEAT Test Step EPC.4A.
EPC.5 CHECK FUEL RETURN PRESSURE		
• Remove fuel return line at junction fitting at left rear of engine. • Install adapter 5663 and Pressure Test Kit 014-00702, or equivalent. • Run engine at 3,300 rpm, no load, transmission in NEUTRAL or PARK. • Record pressure reading. On dual tank vehicles, check both tanks. • Maximum pressure should not exceed 2 psi at 3,300 rpm. **NOTE: Fuel return hose removed in EPC.4A must be connected for this test.**	OK ▶	GO to EPC.6.
	~~OK~~ ▶	SERVICE or REPLACE fuel return line(s) as necessary. REFER to Shop Manual, Section 24-50. REPEAT Test Step EPC.5.
EPC.6 CHECK AIR INTAKE RESTRICTION		
• Remove cap on air cleaner test port and install adapter 5650 and Pressure Test Kit 014-00702, or equivalent.	More than 2 inches H_2O but less than 25 inches H_2O ▶	REMOVE adapter. INSTALL cap on air cleaner port. GO to EPC.7.
• Run engine at 3,300 RPM, no load. • Record restriction reading.	25 inches H_2O or more ▶	REPLACE filter element and CHECK intake system for blockage. REPEAT Test Step EPC.6.
• Restriction should not exceed 25 inches of H_2O.	Less than 2 inches H_2O ▶	CORRECT restriction in fitting on air cleaner test port. REPEAT Test Step EPC.6.

Engine Performance

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.7 CHECK INJECTION PUMP TRANSFER PRESSURE		
○ Remove screw from transfer pump pressure port cover. ○ Install Tool T83T-9000-A or equivalent through cover and O-ring and into port. Install adapter 5650 and Pressure Test Kit 014-00702 or equivalent. ○ Fittings must be tight and not leaking. ○ Run engine at 3,300 rpm, no load, with transmission in NEUTRAL. ○ Record pressure reading. ○ Pressure should be 90 to 110 PSI.	OK ▶ ~~OK~~ ▶	GO to **EPC.8**. REPLACE injection pump. (REFER to Shop Manual, Section 22-08.) If performance problem still exists after installing new pump, CHECK and ADJUST injection pump dynamic timing. (REFER to adjustments in this section.) If performance problem still exists after adjusting timing, GO to **EPC.8**.
EPC.8 ACCELERATOR LINKAGE ADJUSTMENT		
○ With engine off, check that throttle lever contacts injection pump stop at full accelerator pedal depression. Full throttle screw is not adjustable. Tampering may cause injection pump damage. 	OK ▶ ~~OK~~ ▶	GO to **EPC.9**. ADJUST or SERVICE vehicle throttle linkage as necessary. (Refer to Shop Manual, Section 24-60.) GO to **EPC.9**.

Engine Performance

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.9 CHECK ENGINE IDLE SPEED		
• Check engine idle speed as described under Adjustments in this section. • Bring engine up to normal operating temperature. • Idle speed is measured with manual transmission in NEUTRAL and automatic transmission in DRIVE. • Idle speed is shown on Vehicle Emission Control Information (VECI) decal.	OK ▶	GO to **EPC.10**.
	~~OK~~ ▶	ADJUST as necessary. GO to **EPC.10**.
EPC.10 DYNAMIC INJECTION PUMP TIMING**		
• Install Dynamic Timing Meter and check injection pump timing. (Refer to Dynamic Injection Pump Timing.) Compare value to specification and correct for fuel cetane value and altitude. Measure at 1,400 rpm, no load. **Engine must be at normal operating temperature. • Record dynamic timing in Box A, Step 10 of the 6.9L Engine Performance Chart. • Apply +12 volt battery power to the injection pump timing advance solenoid and record dynamic timing in Box B, Step 10 of the 6.9L Engine Performance Chart.	B is more than 25° advanced from A, and A is within ± 2°. ▶	GO to **EPC.11**.
	B is more than 25° advanced from A, and A is not within ± 2°. ▶	ADJUST timing. (REFER to Shop Manual, Section 22-08 and adjustments.) If performance problem still exists after adjusting timing, GO to **EPC.11**.
	B is less than 25° advanced from A.	REPLACE fuel injection pump top cover assembly and REPEAT **EPC.10**.

Engine Performance

TEST STEP	RESULT ▶	ACTION TO TAKE
EPC.11 CHECK INJECTION NOZZLES AND INLET LINES		
NOTE: Perform this check only if engine has an obvious combustion knock or miss. ○ Check injection nozzle inlet lines for kinks or restriction. (Refer to Shop Manual, Section 22-08.) ○ Test injection nozzles as described in this section. **NOTE: Warranty claims for injection nozzles will not be accepted unless the completed Engine Performance chart is submitted with the returned parts.**	Lines and nozzles OK ▶	GO to EPC.12.
	Lines and/or nozzles not OK ▶	REPLACE damaged injection nozzle fuel inlet lines. (REFER to Shop Manual, Section 22-08.) REPLACE injection nozzles as described in this section and Shop Manual, Section 22-08. If performance problem still exists, GO to EPC.12.
EPC.12 CRANKCASE PRESSURE TEST		
○ Remove crankcase depression regulator valve and securely plug opening to prevent blow-by. (Refer to Shop Manual, Section 22-08.) ○ Remove oil filler cap and install adapter 5631, and Pressure Test Kit 014-00702, or equivalent. (Refer to Pressure Test Kit Hook-Up illustration.) ○ Ensure dipstick is seated in dipstick tube. ○ Run engine at 3,300 rpm no load, with transmission in NEUTRAL. ○ Record pressure reading. ○ Pressure should not exceed 6 inches H_2O at 3,300 rpm. **NOTE: Warranty claims for injection pumps will not be accepted unless all tamper-resistant seals are intact and the completed Engine Performance Chart is submitted with the returned parts.**	OK ▶	REPLACE injection pump, and CHECK and ADJUST timing. (REFER to Shop Manual, Section 22-08 and Adjustments in this section.)
	~~OK~~ ▶	Problem is internal to the engine. (REFER to Shop Manual, Section 22-08.)

Fuel System Air Leak Diagnosis

Hard starting, white smoke in the normal engine operating range, poor idle quality, or lack of power under load can be caused by several conditions. One of these conditions is air leaks in the fuel supply system. This procedure is provided to assist in the diagnosis of 6.9L diesel engine fuel system air leaks.

To perform the Fuel System Air Leak Diagnosis, the following adapters (Fig. 29 and 30) need to be assembled as shown from locally available materials.

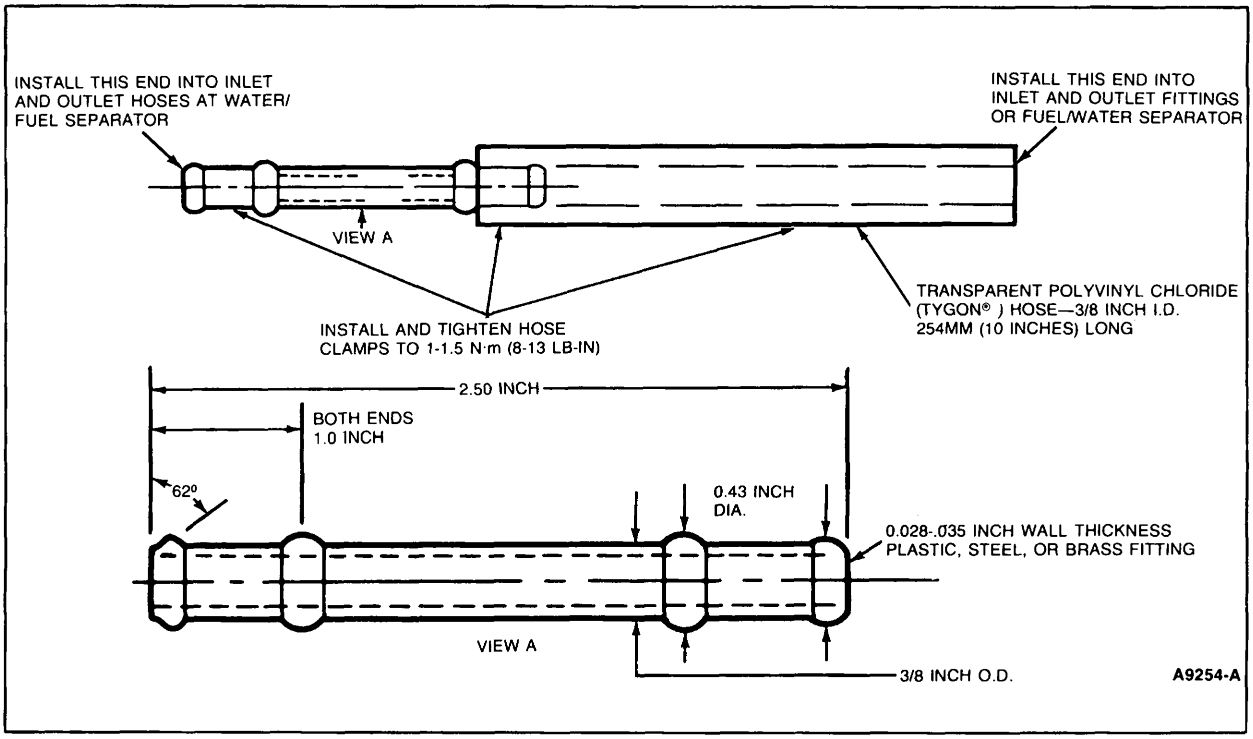

INSTALL THIS END INTO INLET AND OUTLET HOSES AT WATER/ FUEL SEPARATOR
INSTALL THIS END INTO INLET AND OUTLET FITTINGS OR FUEL/WATER SEPARATOR
VIEW A
INSTALL AND TIGHTEN HOSE CLAMPS TO 1-1.5 N·m (8-13 LB-IN)
TRANSPARENT POLYVINYL CHLORIDE (TYGON®) HOSE—3/8 INCH I.D. 254MM (10 INCHES) LONG
2.50 INCH
BOTH ENDS 1.0 INCH
62°
0.43 INCH DIA.
0.028-.035 INCH WALL THICKNESS PLASTIC, STEEL, OR BRASS FITTING
VIEW A
3/8 INCH O.D.
A9254-A

Figure 29 Water/Fuel Separator Adapter, Two Required

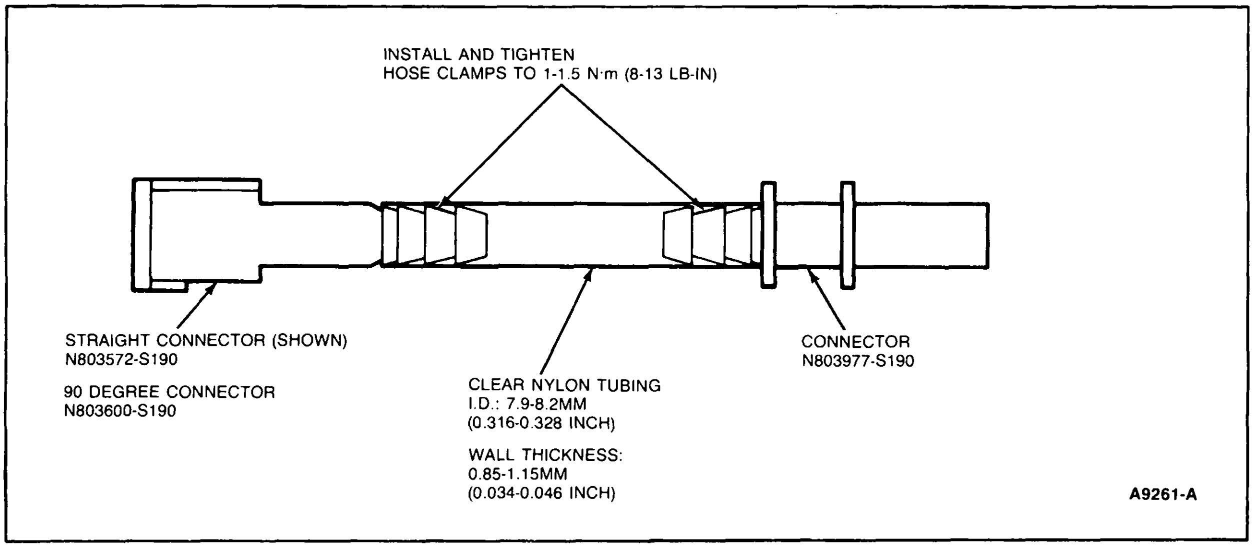
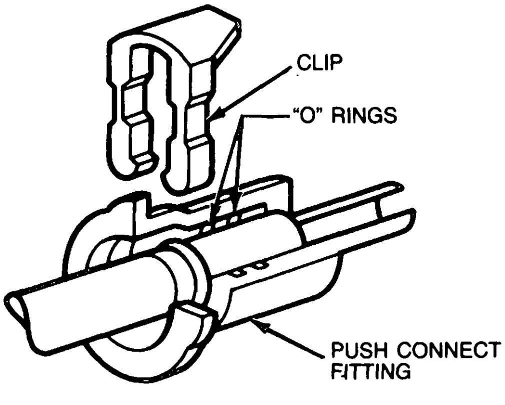
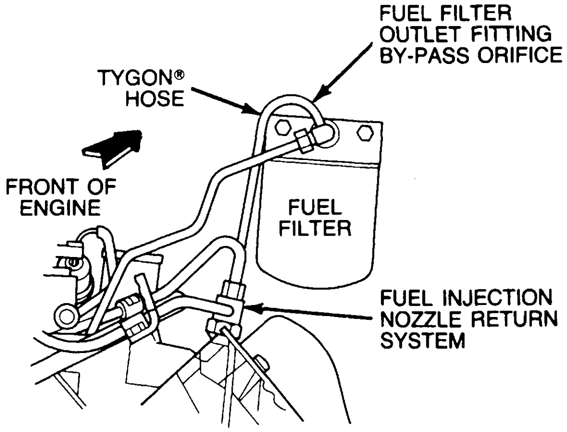

INSTALL AND TIGHTEN HOSE CLAMPS TO 1-1.5 N·m (8-13 LB-IN)
STRAIGHT CONNECTOR (SHOWN) N803572-S190
90 DEGREE CONNECTOR N803600-S190
CLEAR NYLON TUBING I.D.: 7.9-8.2MM (0.316-0.328 INCH)
WALL THICKNESS: 0.85-1.15MM (0.034-0.046 INCH)
CONNECTOR N803977-S190
A9261-A

Figure 30 Selector Valve/Fuel Tank Push Connect Adapter—F-Series (Two Required)

Fuel System Air Leak Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
J1 CHECK HOSE CONNECTIONS		
NOTE: Prior to starting the diagnostic procedure, verify that the fuel tank(s) contain at least a half tank of fuel — the fuel level compensates for the range of vehicle attitudes that may uncover the fuel sender pickup hose or sender by-pass in the fuel tank when the fuel level is low. Visually inspect the fuel system for obvious problems such as kinked hoses, damaged lines or push-connect fittings. • Verify that the push-connect fitting clip is in place. • Verify that the push-connect fittings are properly installed on the tube end by pulling the fitting away from the tube (axially along the tube). The fitting should not pull off from the tube end. If the fitting does pull away, push the fitting axially back on to the tube until a definite click is heard. • Pull and push the fitting one more time to verify proper installation. 	OK ▶ ~~OK~~ ▶	GO to J2. SERVICE or REPLACE fuel lines, clamps or push-connect fittings. REFER to Light Truck Shop Manual, Volume B, Section 25-50, for push-connect fitting service.

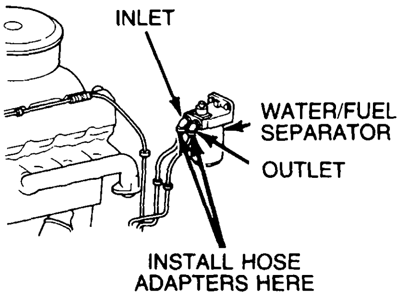
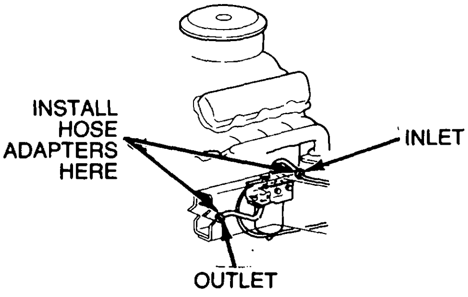
Fuel System Air Leak Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
J2 CHECK SYSTEM FOR BUBBLES OR FOAM • Remove the rubber fuel return bypass hose which connects the fuel filter outlet fitting bypass orifice to the return lines at the fuel injection nozzles. **CAUTION: Care should be taken when removing or installing hose to the plastic fitting at the fuel injection nozzle return lines. Lubricate hose with diesel fuel to ease installation.** • Install a 305mm (12 inch) length of 3/16" I.D. clear polyvinyl chloride, TYGON® hose (to view fuel flow) in place of the above rubber fuel hose, then tighten hose clamps to 1-1.5 N•m (8-13 lb-in). • Run engine at approximately 3,000 rpm for 2 to 3 minutes to clear air from the system, which was induced by the previous operation. • Observe fuel hose for air bubbles at 3,000 engine rpm. • Any continuous stream of bubbles larger than 1.58mm (1/16 inch) indicates air ingestion. A moving concentration of bubbles of any size, or foam, is unacceptable. **NOTE: TYGON® is a registered trademark of Norton Industries Plastics.**  FUEL FILTER OUTLET FITTING BY-PASS ORIFICE TYGON® HOSE FRONT OF ENGINE FUEL FILTER FUEL INJECTION NOZZLE RETURN SYSTEM F-SERIES SHOWN, E-SERIES FILTER MOUNTED ON LH SIDE OF ENGINE	OK ▶	Problem elsewhere in system. REMOVE TYGON® hose and install original hose. REFER to Symptom Analysis in this Section.
	~~OK~~ ▶	GO to J3.

Fuel System Air Leak Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
J3 CHECK DIRECTION OF FLOW		
⊙ Observe direction of flow of bubbles. Bubbles should flow from fuel filter outlet fitting to the fuel injection nozzle return system.	OK ▶	GO to **J4** for single tank system. GO to **J5** for dual tank system
	~~OK~~ ▶	Fuel system is restricted. GO to Engine Performance Diagnosis in this Section. Perform Steps **EPC.4A**. through **EPC.4D**.
J4 CHECK HOSE CONNECTIONS		
⊙ Check for damage to hose connections at rubber fuel hose from chassis fuel line to mechanical lift pump and at inlet and outlet hoses at water separator. ○ Tighten hose clamps to 1-1.5 N•m (8-13 lb-in). ⊙ After tightening hose clamps, run engine for 5 minutes at 3,000 rpm and check for air bubbles in TYGON® hose.	OK ▶	REPLACE TYGON® hose with original hose. Problem resolved.
	~~OK~~ ▶	GO to **J5**.

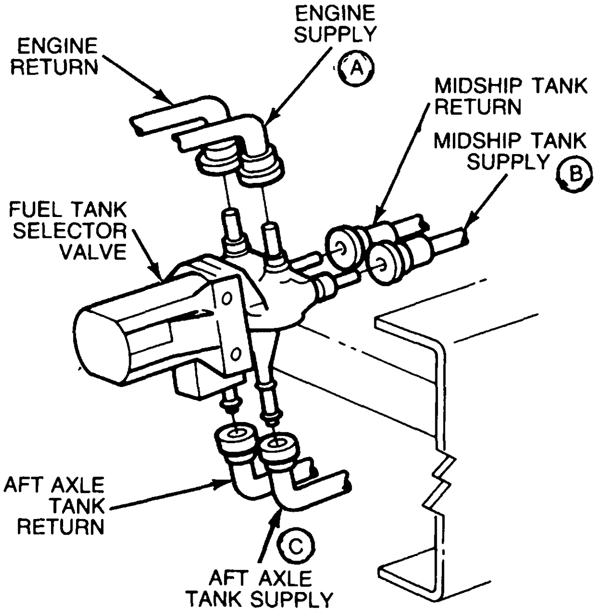
Fuel System Air Leak Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
J5 CHECK WATER/FUEL SEPARATOR FOR BUBBLES • Disconnect water/fuel separator inlet hose. Install hose adapter and tighten clamps to 1-1.5 N•m (8-13 lb-in). **NOTE: Refer to Air Leak Diagnosis — Hose Adapter procedures in this Section.** • Disconnect water/fuel separator outlet hose. Install hose adapter and tighten clamps to 1-1.5 N•m (8-13 lb-in). **CAUTION: Disconnect hoses and install adapters one at a time to prevent hose mix-up.** F-SERIES  INLET WATER/FUEL SEPARATOR OUTLET INSTALL HOSE ADAPTERS HERE E-SERIES  • Operate engine at 1500 rpm for 5 minutes to develop steady fuel flow. Then, operate engine at 3,000 rpm for an additional 2 minutes and check for bubbles in hose adapters.	Air bubbles present in inlet hose, single tank system ▶	SERVICE hoses and connections between water/fuel separator as necessary. REPEAT Test Step J5.
	Air bubbles present in inlet hose, dual tank system ▶	GO to J6.
	Air bubbles present in outlet hose only ▶	CHECK hose adapter at water/fuel separator inlet for air leaks. Operate water/fuel separator drain **with engine off.** REPEAT Test Step J5. If bubbles persist, REPLACE water/fuel separator. REPEAT Test Step J2.

Fuel System Air Leak Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
J6 OPERATE SELECTOR VALVE — DUAL TANKS		
• Start and run engine. • Observe TYGON® hose while switching selector valve between tanks.	Bubbles present in both tank positions ▶	GO to J4.
	Bubbles present in only one tank position ▶	GO to J7.
J7 CHECK SELECTOR VALVE CONNECTIONS		
• Check push-connect fittings for tightness as outlined in Test Step J1. • Fittings should be tight.	OK ▶	GO to J8.
	~~OK~~ ▶	SERVICE push-connect fittings, as necessary. REFER to Shop Manual, Section 25-50 for push-connect fitting service.

Fuel System Air Leak Diagnosis

TEST STEP	RESULT ▶	ACTION TO TAKE
J8 BY-PASS SELECTOR VALVE - Disconnect push-connect fittings from fuel tank selector valve for affected tank. - Install push-connect fitting adapters between fuel lines and selector valve. - Run engine at 3,000 rpm for 2 to 3 minutes to clear any air injested during adapter installation. Run engine an additional 1 to 2 minutes and observe transparent fuel lines in adapters.  ENGINE RETURN ENGINE SUPPLY A MIDSHIP TANK RETURN MIDSHIP TANK SUPPLY B FUEL TANK SELECTOR VALVE AFT AXLE TANK RETURN C AFT AXLE TANK SUPPLY 1. INSTALL ONE ADAPTER AT POINT A 2. INSTALL OTHER ADAPTER AT: POINT B FOR MIDSHIP TANK POINT C FOR AFT AXLE TANK	Bubbles not present in either adapter ▶	Air leak is between fuel tank selector valve and water/fuel separator. SERVICE fuel lines and connections as necessary. REPEAT Test Step J2.
	Bubbles present in both adapters ▶	Air leak is between fuel tank and selector valve. SERVICE fuel lines and connections as necessary. REPEAT Test Step J2.
	Bubbles present in selector valve outlet adapter only. ▶	REPLACE fuel tank selector valve. REPEAT Test Step J2.

Injection Nozzle Testing

Where ideal conditions of good combustion, specified engine temperature control, and absolutely clean fuel prevail, nozzles require little attention. Nozzle trouble is usually indicated by one or more of the following symptoms:

- Smoky exhaust (black)
- Loss of power
- Misfiring
- Increased fuel consumption
- Combustion Knock
- Engine Overheating

When faulty nozzle operation is suspected on an engine that is misfiring or puffing black smoke, a simple test can be made to determine which cylinder(s) is causing the problem.

- Run the engine at the RPM which makes the problem most pronounced.
- Momentarily loosen the high pressure fuel inlet line connection on one nozzle assembly one half to one turn. Then, tighten connection to specification.
- Check each cylinder in the same manner.
- If one nozzle is found where loosening makes no difference in the misfiring, or the puffing black smoke stops, that nozzle should be tested. Only the suspect nozzle(s) should be tested.

Remove suspect nozzles as outlined in Shop Manual, Section 22-08. After removing nozzle(s) from the engine, the Injection Nozzle Test should be performed. This test will provide valuable information regarding the condition of the nozzle(s). A clean workbench, clean washing fluid containers, clean tools, and clean hands are all essential to produce satisfactory results.

NOTE: It is advisable to test the nozzles before cleaning them.

Injection Nozzle Testing

Figure 31 shows the Rotunda Injection Nozzle Tester, Model No. 014-00300, used for this test.

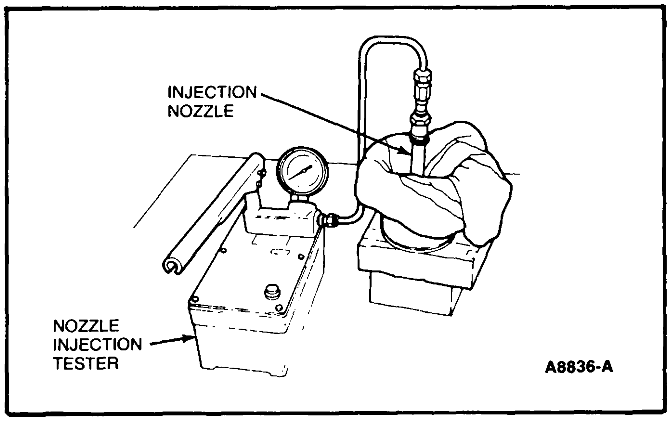


Figure 31 Injection Nozzle Tester

NOTE: Perform this check only if engine has an obvious combustion knock or miss.

1. Prepare stand for making tests. Fill stand reservoir with clean Calibration Fluid. Open tester valve slightly and operate tester handle to expel air from tester and outlet pipe. Operate tester until solid fluid (without air bubbles) flows from end of outlet pipe. Close tester valve.
2. Connect injection nozzle to test stand. Care should be taken to avoid "cross-threading." Tighten connector nut securely with end wrench. Nozzle Adapter which is supplied with tester 014-00300 has right hand thread to nozzle assembly and left hand thread to tester piping.
3. Bleed air from nozzle. Open stand valve and operate tester handle for eight to ten quick strokes to expel (bleed) air from injection nozzle. Fluid should discharge from the spray hole in nozzle tip.

   WARNING: ALWAYS WEAR APPROVED SAFETY GLASSES WHEN OPERATING THE TESTER. VOLATILE LIQUIDS CAN BE EXTREMELY FLAMMABLE WHEN VAPORIZED. AVOID ANY CONDITIONS (SPARKS, OPEN FLAMES, LIT CIGARETTES, ETC.) WHICH MIGHT IGNITE THE FLUID USED DURING THE TEST PROCEDURE. THE ONLY LIQUID APPROVED FOR USE IN THIS TESTER IS SAE CALIBRATION NO. 208629, OR EQUIVALENT CALIBRATION FLUID (SAE J968D OR ISO 4113).

   WHEN A NOZZLE IS BEING TESTED OR IS IN OPERATION, KEEP HANDS AND OTHER PARTS OF THE BODY AWAY FROM THE NOZZLE. THE LIQUID DISCHARGE LEAVES THE NOZZLE TIP WITH SUFFICIENT FORCE TO PENETRATE THE SKIN AND CAUSE SERIOUS INJURY. THE NOZZLE TIP SHOULD BE ENCLOSED IN A TRANSPARENT RECEPTACLE IF AVAILABLE.

4. Check nozzle opening pressure. Close pump valve, and operate pump handle in slow even strokes to bring system up to pressure. Record highest pressure reached before nozzle opens. Repeat operation, increasing handle speed if necessary to establish consistant readings. Refer to Fig. 32 for nozzle opening pressures.

   NOTE: Disregard tip leakage during this test.

   NOTE: Spray pattern testing is not required.

Injection Nozzle Testing

NEW		USED (MINIMUM)	
kPa	PSI	kPa	PSI
12,928 ± 517	1,875 ± 75	9,825	1,425

①Calibration code: 468J-R00 and 468X-ROD.

②Be sure to use injectors with stamped code "B" or "BB"

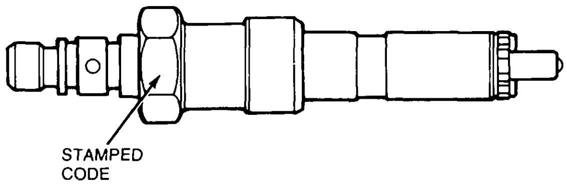


Figure 32 Nozzle Opening Pressure

5. Check for tip leakage. Blow nozzle tip dry using filtered compressed air. Operate test pump to maintain pressure at about 1378 kPa (200 psi) below the opening pressure obtained in Test 1. Wetting of the nozzle tip is acceptable as long as a drop does not fall, within five seconds (Fig. 33).

NOTE: Make sure that any accumulation at the nozzle tip is **not** due to test fluid leaking down the outside of the nozzle body from the return openings. If questionable, wrap a shop cloth around the nozzle body to prevent fluid leaking down the outside of the nozzle body from reaching the tip.

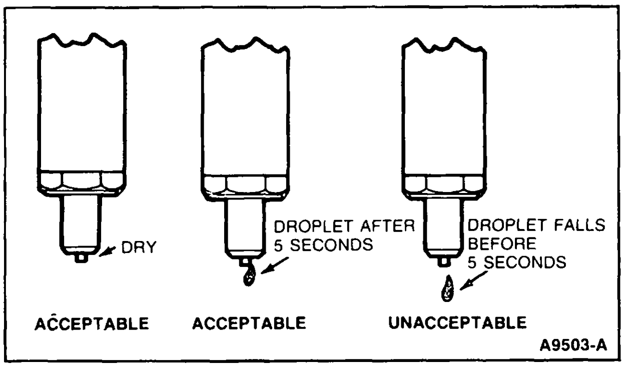


Figure 33 Nozzle Leakage Patterns

6. After testing is completed, make sure to open the pump valve to release the built up pressure prior to removing the nozzle from the tester. When nozzle is removed, cap the nozzle tip and inlet until installed back in engine.

NOTE: If nozzle passes the nozzle opening pressure and tip leakage tests, it is suitable for further service in the engine.

NOTE: Nozzles showing leakage at nozzle tip spray hole or opening pressure below the minimum permissible limit, are damaged or worn and must be replaced, if within warranty coverage. Servicing the nozzle(s) (disassemble, clean and rebuild) in lieu of replacement to correct nozzle tip leakage or low opening pressure is only permissible beyond the warranty period if so desired.

NOTE: Warranty claims for replacement of the nozzle(s) will not be accepted unless the **completed** Engine Performance (Diagnostic) Chart is submitted with the returned part(s).

METRICS

INTRODUCTION

Most threaded fasteners are covered by specifications that define required mechanical properties, such as tensile strength, yield strength, proof load and hardness. These specifications are carefully considered in initial selection of fasteners for a given application. To assure continued satisfactory vehicle performance, replacement fasteners used should be of the correct strength, as well as the correct nominal diameter, thread pitch, length, and finish.

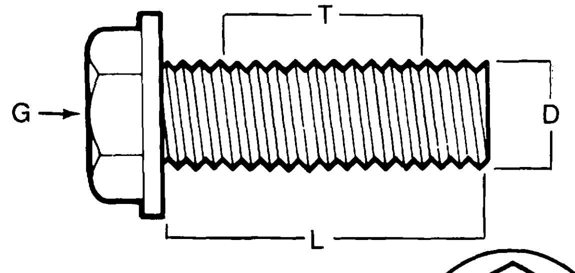
Most original equipment fasteners (English system or Metric) are identified with markings or numbers indicating the strength of the fastener. These markings are described in the pages that follow. Attention to these markings is important in assuring that the proper replacement fasteners are used.

Further, some metric fasteners, especially nuts, are colored blue. This metric blue identification is in most cases a temporary aid for production start-up, and color will generally revert to normal black or bright after start-up.

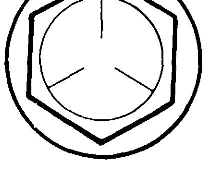
English system and metric system fasteners are available through your Ford Parts and Service operation.

NOMENCLATURE FOR BOLTS

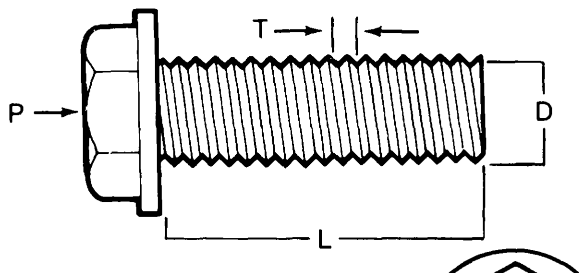
(ENGLISH) INCH SYSTEM
Bolt, 1/2-13x1



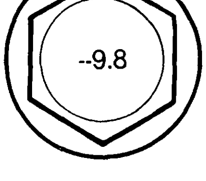
G—Grade Marking (bolt strength)
L—Length, (inches)**
T—Thread Pitch (thread/inch)
D—Nominal Diameter (inches)



METRIC SYSTEM
Bolt M12-1.75x25



P—Property Class* (bolt strength)
L—Length (millimeters)**
T—Thread Pitch (thread width crest to crest mm)
D—Nominal Diameter (millimeters)



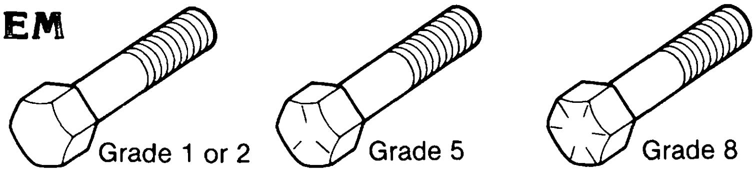
*The property class is an Arabic numeral distinguishable from the slash SAE English grade system.

**The length of all bolts is measured from the underside of the head to the end.

METRICS

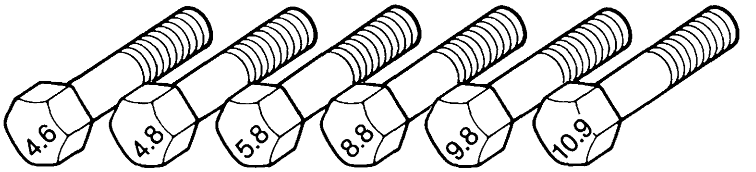
BOLT STRENGTH IDENTIFICATION

(ENGLISH) INCH SYSTEM



English (Inch) bolts—Identification marks correspond to bolt strength—increasing number of slashes represent increasing strength.

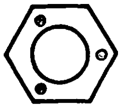
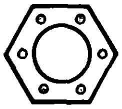
METRIC SYSTEM



Metric bolts—Identification class numbers correspond to bolt strength—increasing numbers represent increasing strength. Common metric fastener bolt strength property are 9.8 and 10.9 with the class identification embossed on the bolt head.

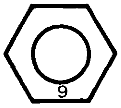
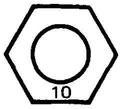
HEX NUT STRENGTH IDENTIFICATION

(ENGLISH) INCH SYSTEM

Grade	Hex Nut Grade 5	Hex Nut Grade 8
Identification	 3 Dots	 6 Dots

Increasing dots represent increasing strength.

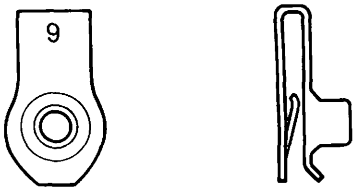
METRIC SYSTEM

Class	Hex Nut Property Class 9	Hex Nut Property Class 10
Identification	 Arabic 9	 Arabic 10

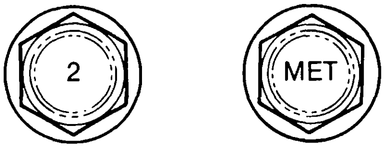
May also have blue finish or paint daub on hex flat. Increasing numbers represent increasing strength.

OTHER TYPES OF PARTS

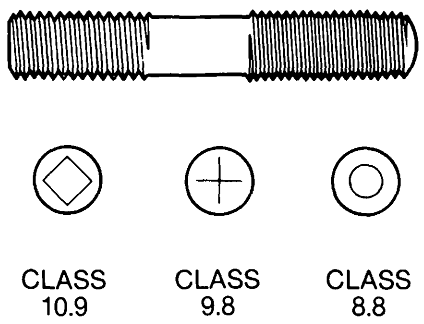
Metric identification schemes vary by type of part, most often a variation of that used of bolts and nuts. Note that many types of English and metric fasteners carry no special identification if they are otherwise unique.



—Stamped U-Nuts



—Tapping, thread forming and certain other case hardened screws



—Studs, Large studs may carry the property class number. Smaller studs use a geometric code on the end.

ENGLISH METRIC CONVERSION

Description	Multiply	By	For Metric Equivalent
ACCELERATION	Foot/sec^2	0.304 8	metre/sec^2 (m/s^2)
	Inch/sec^2	0.025 4	metre/sec^2
TORQUE	Pound-inch	0.112 98	newton-metres (N·m)
	Pound-foot	1.355 8	newton-metres
POWER	horsepower	0.746	kilowatts (kw)
PRESSURE or STRESS	inches of water	0.2488	kilopascals (kPa)
	pounds/sq. in.	6.895	kilopascals (kPa)
ENERGY or WORK	BTU	1 055.	joules (J)
	foot-pound	1.355 8	joules (J)
	kilowatt-hour	3 600 000. or 3.6 × 10^6	joules (J = one W's)
LIGHT	foot candle	10.76	lumens/metre^2 (lm/m^2)
FUEL PERFORMANCE	miles/gal	0.425 1	kilometres/litre (km/l)
	gal/mile	2.352 7	litres/kilometre (l/km)
VELOCITY	miles/hour	1.609 3	kilometres/hr. (km/h)
LENGTH	inch	25.4	millimetres (mm)
	foot	0.304 8	metres (m)
	yard	0.914 4	metres (m)
	mile	1.609	kilometres (km)
AREA	inch^2	645.2	millimetres^2 (mm^2)
		6.45	centimetres^2 (cm^2)
	foot^2	0.092 9	metres^2 (m^2)
	yard^2	0.836 1	metres^2
VOLUME	inch^3	16 387.	mm^3
	inch^3	16.387	cm^3
	quart	0.016 4	litres (1)
	quart	0.946 4	litres
	gallon	3.785 4	litres
	yard^3	0.764 6	metres^3 (m^3)
MASS	pound	0.453 6	kilograms (kg)
	ton	907.18	kilograms (kg)
	ton	0.90718	tonne
FORCE	kilogram	9.807	newtons (N)
	ounce	0.278 0	newtons
	pound	4.448	newtons
TEMPERATURE	degree farenheit	0.556 (°F -32)	degree Celsius (°C)

DECIMAL AND METRIC EQUIVALENTS

Fractions	Decimal Inch	Metric mm
1/64	.015625	.397
1/32	.03125	.794
3/64	.046875	1.191
1/16	.0625	1.588
5/64	.078125	1.984
3/32	.09375	2.381
7/64	.109375	2.778
1/8	.125	3.175
9/64	.140625	3.572
5/32	.15625	3.969
11/64	.171875	4.366
3/16	.1875	4.763
13/64	.203125	5.159
7/32	.21875	5.556
15/64	.234375	5.953
1/4	.250	6.35
17/64	.265625	6.747
9/32	.28125	7.144
19/64	.296875	7.54
5/16	.3125	7.938
21/64	.328125	8.334
11/32	.34375	8.731
23/64	.359375	9.128
3/8	.375	9.525
25/64	.390625	9.922
13/32	.40625	10.319
27/64	.421875	10.716
7/16	.4375	11.113
29/64	.453125	11.509
15/32	.46875	11.906
31/64	.484375	12.303
1/2	.500	12.7

Fractions	Decimal Inch	Metric mm
33/64	.515625	13.097
17/32	.53125	13.494
35/64	.546875	13.891
9/16	.5625	14.288
37/64	.578125	14.684
19/32	.59375	15.081
39/64	.609375	15.478
5/8	.625	15.875
41/64	.640625	16.272
21/32	.65625	16.669
43/64	.671875	17.066
11/16	.6875	17.463
45/64	.703125	17.859
23/32	.71875	18.256
47/64	.734375	18.653
3/4	.750	19.05
49/64	.765625	19.447
25/32	.78125	19.844
51/64	.796875	20.241
13/16	.8125	20.638
53/64	.828125	21.034
27/32	.84375	21.431
55/64	.859375	21.828
7/8	.875	22.225
57/64	.890625	22.622
29/32	.90625	23.019
59/64	.921875	23.416
15/16	.9375	23.813
61/64	.953125	24.209
31/32	.96875	24.606
63/64	.984375	25.003
1	1.00	25.4

TORQUE CONVERSION

NEWTON METRES (N·m)	POUND-FEET (LB-FT)
1	0.7376
2	1.5
3	2.2
4	3.0
5	3.7
6	4.4
7	5.2
8	5.9
9	6.6
10	7.4
15	11.1
20	14.8
25	18.4
30	22.1
35	25.8
40	29.5
50	36.9
60	44.3
70	51.6
80	59.0
90	66.4
100	73.8
110	81.1
120	88.5
130	95.9
140	103.3
150	110.6
160	118.0
170	125.4
180	132.8
190	140.1
200	147.5
225	166.0
250	184.4

POUND-FEET (LB-FT)	NEWTON METRES (N·m)
1	1.356
2	2.7
3	4.0
4	5.4
5	6.8
6	8.1
7	9.5
8	10.8
9	12.2
10	13.6
15	20.3
20	27.1
25	33.9
30	40.7
35	47.5
40	54.2
45	61.0
50	67.8
55	74.6
60	81.4
65	88.1
70	94.9
75	101.7
80	108.5
90	122.0
100	135.6
110	149.1
120	162.7
130	176.3
140	189.8
150	203.4
160	216.9
170	230.5
180	244.0